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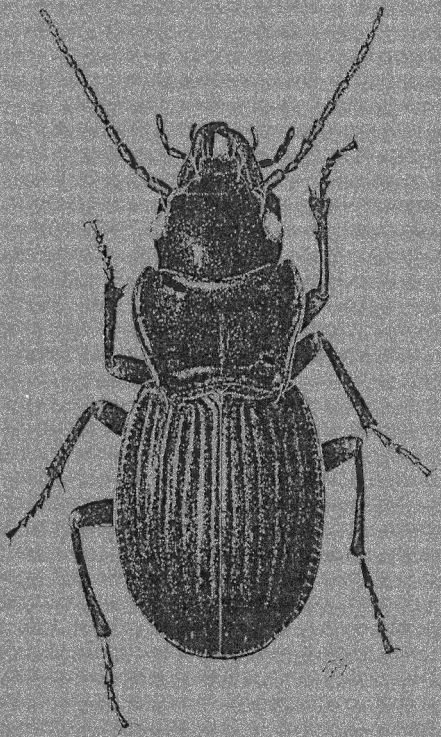

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Covery The carabid beetle *Nurus* has about 10 large, heavy-bodied species which occur along the eastern seaboard of Australia from northern NSW to north Qld. They live in spiral burrows which they excavate with their mandibles. Prey is ambushed from the burrow entrance at night. Females brood their eggs and first instar larvae in the burrow. *Nurus brevis* Motschulsky, 1865 occurs near Lismore and is listed as rare and endangered by NSW legislation. Illustration by Geoff Thompson.

EXOMETOECA NYCTERIS MEYRICK (LEPIDOPTERA: HESPERIIDAE: PYRGINAE): LIFE HISTORY AND MORPHOLOGICAL STUDIES

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Abstract

The life history of the Western Australian endemic skipper *Exometoeca nycteris* Meyrick is described and illustrated. Juvenile and adult morphology, distribution and behavior indicate that this uncommon, cryptic species is a geographic and taxonomic isolate. The larval food plants are *Tetratheca hispidissima* and *T. hirsuta* (Tremandraceae), both of which are restricted to southwestern Western Australia. The monotypic genus *Exometoeca* Meyrick is compared to allied genera of the Australian subfamily Pyrginae.

Introduction

The Western Flat *Exometoeca nycteris* Meyrick, 1888 is an Australian endemic, monotypic skipper belonging to the subfamily Pyrginae ('Flats'). It is known only from the southwestern corner of Western Australia and ranges from Chittering to Margaret River and Albany (Braby 2000). This distribution is unique for genera of Australian Hesperiidae and *E. nycteris* is the only species of the subfamily to occur in southwestern Australia. Few localities are recorded for this small skipper and the life history has eluded lepidopterists for over a hundred years.

In the Perth area adults are most commonly seen in October. Further south near Albany the peak flying time is late November and early December. In early December 1999 we searched localities near Albany where the butterfly was known to occur. A population was found at Bakers Junction Nature Reserve (34°54'S 117°56'E) enabling us to closely study the habits, biology and food plant of this species. These observations were subsequently compared with a northern site at Lesmurdie near Perth, where larvae were found on a similar food plant.

Life history

Food plants. Tremandraceae: *Tetratheca hispidissima* Steetz from Bakers Junction Nature Reserve near Albany and *Tetratheca hirsuta* Lindley from Lesmurdie near Perth.

Egg (Figs 3-4, 26-27). Diameter 0.8 mm; dome shaped, 18-21 prominent vertical ribs, broken and inter-connecting near micropyle. Very faint cross-ribbing is present between the vertical ribs, the surface punctured with scattered pores. The micropyle (Fig. 27) is a simple circular and expanding

series of quadrant pores. The egg is pale yellow when first laid but darkens to orange-yellow within a day or two (Figs 3-4). Prior to hatching the micropyle darkens, the black larval head showing through the chorion.

First instar larva (Figs 5-6). Length 2-4 mm. Head large and rounded with a slight dorsal groove, shiny black and covered with numerous pale clubbed or simple setae. Body yellow at first but turning slightly greenish after a few days, covered with short cup-shaped or clubbed setae (Fig. 11), the anal segments with longer simple setae.

Second instar larva. Length 4-6 mm. Similar to above, but body green with an indistinct darker mid-dorsal line, posterior segment yellowish. Head slightly produced dorsally and sclerotized, brown with a pair of lighter brown stripes dorsally and either side of frons. Both head and body are covered with short cup-shaped and clubbed setae. At first the second instar larva appears to have an extended or raised prothoracic plate, but this disappears after a few days.

Third instar larva (Figs 7-8). Length 6-8 mm. Body green with indistinct darker mid-dorsal line, similar to second instar, but head capsule with two pronounced dorsal horns. Head colour very variable, some entirely dark brown, others more predominantly pale greenish with dark brown or red-brown markings.

Fourth instar larva (Fig. 10). Length 8-12 mm. Similar to third instar, body green and sparsely covered with short, clubbed setae. The head capsule is also covered with clubbed setae. It is predominantly green with variable red-brown markings.

Final instar larva (Fig. 12). Length 17-19 mm. Similar to fourth instar but with head green, usually with prominent red markings extending midway either side of frons and upwards to well pronounced dorsal horns.

Pupa (Figs 13,16). Length 15 mm. Stout and rounded, bright green, covered with mottled pale grey waxy exudation. Head (operculum) (Fig. 9) with blunt brown central projection. Thoracic spiracle, bright reddish brown, round and prominent. Wing-case distally speckled with black along venation lines. Proboscis case (Fig. 25) dorsally projecting beyond wing case to a brown swollen tip. Abdominal segments sparsely covered with short, simple, pale setae; spiracles dark brown. Cremaster brown, moderately long, decurved, laterally convex; tip with short pale hooks. Mid-section of pupa supported by Y-shaped strong silken girdle (partly shown in Fig. 13).

Adult (Figs 1, 2, 17). Male and female similar, reddish brown above with hyaline spots in the median area of the forewing, underside light greyish brown with dark brown to purplish brown markings in distal area, hyaline spots as above, male slightly smaller, forewing length 15 mm; wing venation (Fig.18) with forewing cell medium and blunt, M_2 slightly nearer M_1 than M_3

at point of origin, CuA_2 nearer to base than to CuA_1, humeral vein present near base, male with narrow costal fold from base to Rs_2, hindwing with M_2 well defined, discocellulars equal, concave and parallel to margin; labial palpus (Fig. 19) brown above, cream beneath with second segment moderately broad, oval, elliptical, laterally depressed, slightly twisted, third segment long, narrow, and directed forward (porrect); antenna (Figs 1-2) moderate with shaft 40-45 segments, club (Fig. 20) 21 segments tapered evenly, thickening 1/3rd its length, bent 2/3rd its length, nudum 14, reddish brown: legs (Fig. 21) mid brown, pale brown beneath, moderately long, with one pair of spurs on mid tibia, two pairs of spurs on hind tibia (0:1:2), fore tibia with long, slightly curved apophysis.

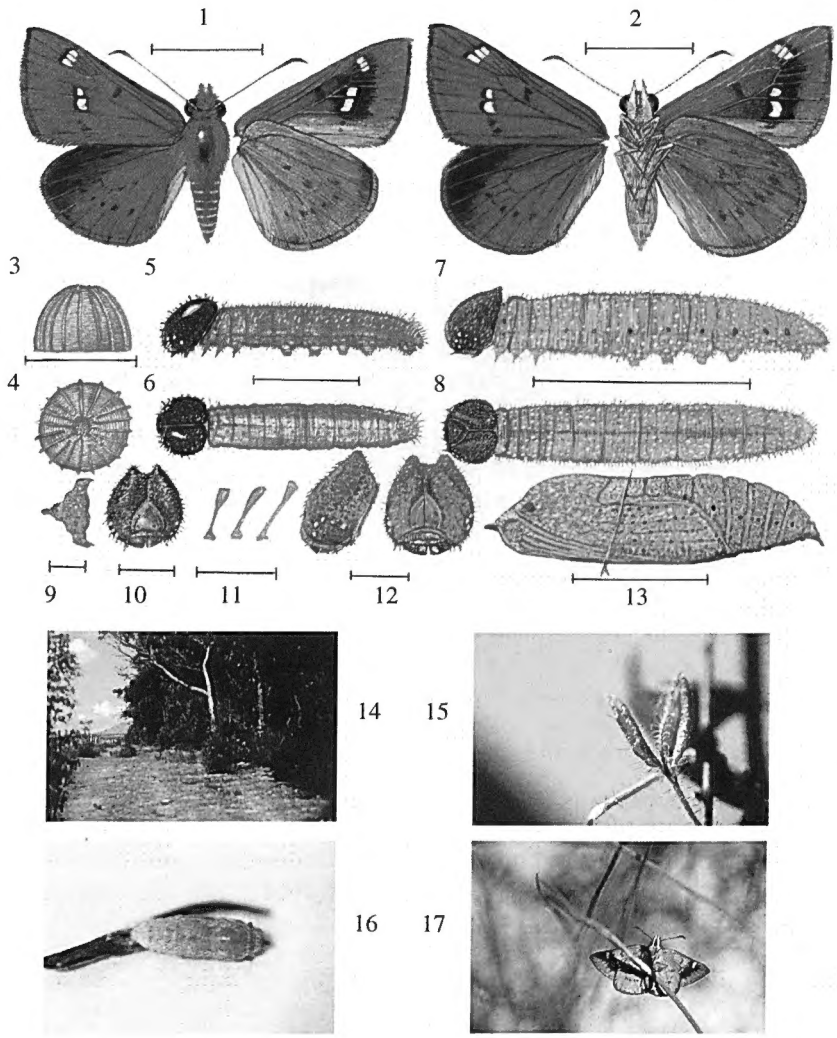
Male genitalia (Fig. 22). Aedeagus moderate with simple rounded posterior tip, valvae symmetrical, simple, divided with dorsal segment greatly reduced, ventral segment curved upward, slightly sclerotized and with blunt, toothed tip, saccus long, two-thirds length of valvae, juxta simple ring-shaped, tegumen hood-shaped with deep paired gnathos, tegumen and uncus junction with paired, broadly curved, crescent shaped lateral flange, uncus a simple dorsally pointed, decurved spatulate process, slightly hooked ventrally.

Female genitalia (Fig. 23). Papilla anellus a simple, rounded, concave paired process attached to a crescent-shaped sclerotized segment 9, apophysis moderate, lamella antevaginalis (sterigma plate) prominent, broadly dish-shaped with slightly bifid, lipped ventral surface, ostium bursae (caudal chamber) narrow ring-shaped, slightly tilted dorsally, ductus bursae long and narrow, coiled to spherical corpus bursae (bursa copulatrix) with paired, ventrally placed, spiracle-like signum covered with short spines.

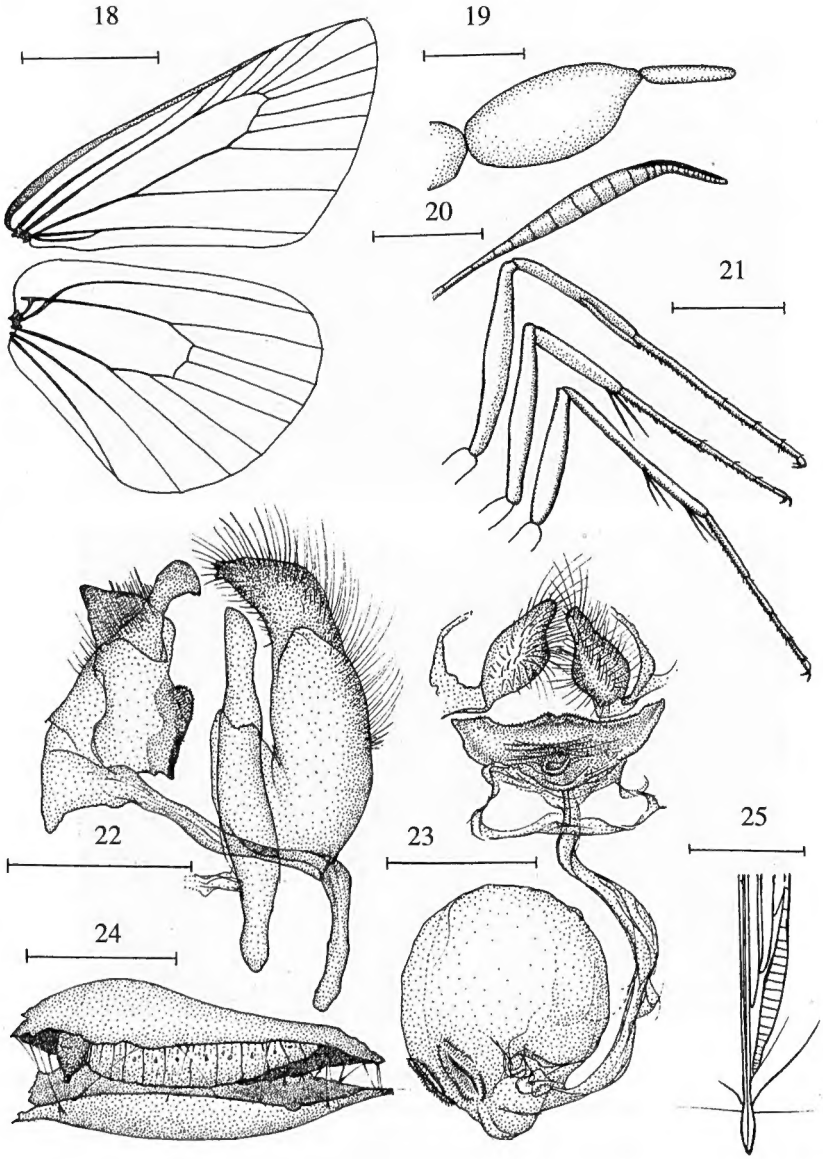
Location and habitat

Bakers Junction Nature Reserve is located 13 km north of Albany. It covers an area of 1090 ha in a gently undulating upland dissected by shallow valleys. Much of the surrounding land has been cleared for farming. The bulk of the reserve supports a low woodland of jarrah (*Eucalyptus marginata*) and sheoak (*Allocasuarina fraseriana*). Dense *Homalospermum firmum* heath and associated low woodland complexes of *Eucalyptus marginata*, *E. staeri*, *Banksia attenuata* and *Agonis parviceps* are found along the drainage lines (Griffin 1985). The *E. nycteris* site is in jarrah/sheoak low woodland, within which are small open areas of winter-wet heathland. These heathland areas support low flowering shrubs, including *Pimelea* sp. and *Dasypogon bromeliifolius* and a strong component of other monocotyledons.

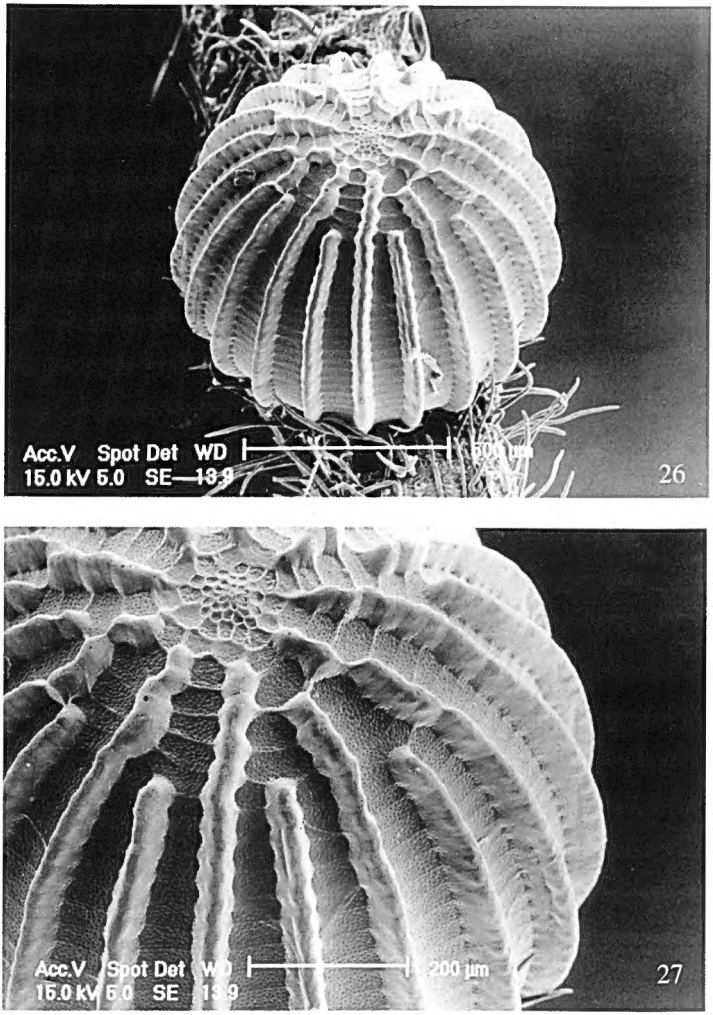
The northern site at Lesmurdie is on the west-facing upper slopes of the Darling Scarp, overlooking Perth. It is an open woodland of Marri (*Eucalyptus calophylla*) and Wandoo (*Eucalyptus wandoo*), forming the transition zone between jarrah forest and adjacent areas of low heathland on gravel and rocky soil.



Figs 1-17. Biology and habitat of *Exometoeca nycteris*. (1) male upper and underside; (2) female upper and underside; (3) lateral view of egg; (4) dorsal view of egg; (5) lateral view of 1st instar larva; (6) dorsal view of 1st instar larva; (7) lateral view of 3rd instar larva; (8) dorsal view of 3rd instar larva; (9) operculum of pupa; (10) frons of 4th instar larva; (11) larval setae; (12) lateral view and frons of final instar larva; (13) lateral view of pupa; (14) flight and breeding area at Bakers Junction Nature Reserve; (15) egg laid on leaf axil of *Tetratheca hispidissima*; (16) ventral view of pupa; (17) basking adult male in 'signalling' posture. Scale lines: Figs 1-2 = 10 mm; figs 3-6 = 1 mm; figs 7, 8, 13 = 5 mm; figs 9, 10, 12 = 2 mm; fig. 11 = 0.5 mm.



Figs 18-25. Morphology and biology of *Exometoeca nycteris*. (18) wing venation of male; (19) labial palpus; (20) antennal club; (21) fore, mid and hind tibia of male; (22) lateral view of male genitalia (everted upwards); (23) ventral view of female genitalia; (24) leaf-litter shelter of 4th instar larva; (25) pupal proboscis case. Scale lines: Figs 18, 24 = 5 mm; figs 19, 22, 23 = 1 mm; figs 20, 21, 25 = 2 mm.



Figs 26-27. Micrographs of *Exometoeca nycteris* egg.

Life history and behavioural observations

Initial observations were made at Bakers Junction Nature Reserve (Fig. 14) on 1 December 1999. Males were observed flying slowly, at the edge of and within damp areas of woodland. They appeared to be seeking freshly emerged females and on one occasion four males were seen hovering within a metre of each other, investigating a shaded area of dense thicket.

Nearby, in sunny areas, females were observed on flowering herbs. One female was seen to fly directly and swiftly from a flower, across an open area of heathland, to a shaded, damp area of the surrounding woodland. Here, after quick inspection, it oviposited near the tip of a *Tetratheca hispidissima* plant (Fig. 15) growing amongst other understorey species. The female then moved away rapidly. Careful examination of other *T. hispidissima* plants in the vicinity produced more eggs, all of which were laid on the young tips of the food plant, most frequently in the axil between the stem and uppermost leaf.

Eggs collected at Bakers Junction Nature Reserve were then transferred to potted *T. hispidissima* plants (at Wanneroo) for observation. Young larvae were also placed on potted *T. thymifolia* (an eastern Australian species) and held at Dudley, NSW. The eggs hatched within 12-13 days and the first instar larvae initially ate most of the egg-shell, then subsequently fed on the growing tips or youngest leaves of the food plant. Most larvae constructed flimsy dome-shaped shelters on the underside of a leaf, pulling the edges of the leaf closer together with strands of silk. Other larvae rested in the axil between stem and uppermost leaf (where the egg was laid), wrapping strands of silk around both for protection. The young larvae remained in their shelters, feeding occasionally on either their leaf-shelter or nearby leaves. Periodically new shelters were constructed as the old ones were eaten away. The larvae rested upside-down and were extremely cryptic. The green body colour matched the foliage perfectly, while the dark markings on the head capsules matched discoloured patches on the leaves. As larvae increased in size they sometimes moved from their leafy shelters on the food plant to construct new more substantial shelters on the ground (Fig. 24). These shelters were constructed from leaf litter and bark near the base of the food plant. Periodically larvae would leave their shelters to feed and then, within 15-20 minutes, return to their shelters.

Visits were made to Lesmurdie and Bakers Junction Nature Reserve during the year to monitor the progress of larval development in the wild. At Lesmurdie larvae fed sporadically in October and November when fresh young leaves of the food plant *T. hirsuta* were available. However, in the hot dry summer months the plants clasped their leaves close to the stems, probably to minimise water loss. During this time there was no sign of larval activity. Larvae only resumed feeding again when the food plants became more turgid in response to autumn rain. Larvae were mature by August and were found in shelters formed from a number of leaves of the food plant, or incorporating fallen dead leaves. They pupated in their shelters in late August and early September. Adults emerged after 20 days.

At Bakers Junction Nature Reserve and at Dudley, NSW the situation was rather different. In these areas larvae fed intermittently throughout the summer, reaching third instar by March. The milder southern and south-eastern conditions no doubt enabled the *Tetratheca* food plants to maintain

fresh growth on which the young larvae could feed more readily. One captive larva pupated at the end of October and emerged approximately 21 days later.

Little has been published on the habits of adult *E. nycteris*. Common and Waterhouse (1981) stated that the species flies for about an hour in the morning before 1000 h and then again for a similar period after midday (an observation attributed to A.N. Burns). However, Barrett and Burns (1951) state that 'It does not appear until about nine or later in the morning, it increases until after midday when it gradually disappears and by four in the afternoon not a specimen is to be seen'. At Bakers Junction Nature Reserve, adult *E. nycteris* were active during sunny spells throughout the day between 0900 and 1500 h. Both males and females congregated in small open areas of winter-wet heathland, where they visited the flowers of *Pimelea* sp. and *Dasypogon bromeliifolius*. Males also established 'territories' in these open areas, often perching on prominent dead sticks or taller sedges (Fig. 17). At other times they were seen spiralling together high above the ground.

The usual feeding posture of *E. nycteris* is typical of pyrginid skippers, with wings outstretched horizontally or occasionally upright over the thorax, or even bent slightly downward around the flower head. The wing tips of this species (as in many skippers of this subfamily) are slightly depressed. However, when resting or basking both sexes generally revert upside-down, wings spread flat, under curving monocotyledon leaves. This posture is assumed either head upwards or head downwards and exposes the strongly marked apical area of the underside of the wing either side of the leaf-blade (Fig. 17). We believe that this may be an intraspecific signalling pattern, which is in contrast to the cryptic upperside of the wings that is exposed when feeding.

Predators and parasites

One predator of adult *E. nycteris* was observed at Bakers Junction Nature Reserve, this being an unidentified species of a reddish-coloured crane fly (Tipulidae) that was carrying a freshly emerged but dead adult female across a clearing. A few small parasitic wasps (*Eriborus* sp. [Ichneumonidae: Campopleginae]) also emerged in captivity from fourth instar larvae of *E. nycteris*. The wasp is probably undescribed. This is the first record of a skipper as host for *Eriborus* Foerster, which usually parasitises pyralid moth larvae (I. D. Gauld, pers. comm.).

Discussion

Exometoeca nycteris is a geographically isolated taxon known only from southwestern Western Australia. The male has a costal fold (Fig. 18) not previously recorded for this monotypic genus, but other secondary sexual structures (i.e. tibial and anal hair-tufts, wing-sterigma) are absent. The skipper shows no unusual structural features, apart from the horned larval head, the long third segment of the labial palpus and long saccus and curved

uncus flange of the male genitalia, but these are not unique in Pyrginae. A well-defined hindwing vein M_2 is also found in several less specialised pyrginid skippers, such as some species of the *Erynnis* Schrank group of genera from Europe and North and South America and the unique Australian *Euschemon* Doubleday. Tibial spur configuration of *E. nycteris* (0:2:4) is shared by all Australian pyrginid genera (note that this is contrary to Evans' 1949 diagnosis). The structure of the female genitalia indicates that *E. nycteris* may be distantly related to the Australian *Netrocoryne* C. & R. Felder, the Madagascan and African *Eagris* Guenée or the pan-tropical *Celaenorrhinus* Hübner. However in these genera the first instar larvae make distinctive, elaborate circular or rectangular shelters cut from the leaf of the food plant and have differing features of adult and juvenile morphology. The generally unspecialised adult and juvenile morphology suggests that *E. nycteris* is a somewhat 'primitive' skipper and it appears to have no close relatives.

The family Tremandraceae, endemic to southern Australia, was previously unrecorded as a larval food plant for Hesperiidae. It comprises about 47 species distributed in 3 genera. *Tetratheca* forms the bulk of these (see Thompson 1976), with 24 species in Western Australia alone. The two known larval food plants, *T. hirsuta* and *T. hispidissima*, are multi-stemmed shrubs that grow to about 1 m high. The former species grows in laterite, grey sand and granite soils and is found generally from about Geraldton to near Albany; the latter species is found on sand, lateritic sand and loam and is restricted to the far southwest of Western Australia (Keighery 1979). The family Tremandraceae is placed in the Order Rutales with apparent close affinities to Polygalaceae, but also with affinities to Malpighiaceae (Malpighiales) (Bhattacharyya and Johri 1998). Genera and species of Malpighiaceae are recorded as larval food plants of several pyrginid and coeliadinid skippers, especially in tropical countries.

Further searches for colonies of this skipper are needed to establish its conservation status. *E. nycteris* appears to have a very short flying period. Only one brood has been recorded from late spring (northern range: Perth area) to early summer (southern range: Albany area). Very few colonies are known, but this may be an artifact of a short flying season, localised occurrence or specialised habitat. Although local, the larval food plants are fairly broadly distributed in southwestern Western Australia and *E. nycteris* may be more widespread and locally common than previously thought.

Dried *Tetratheca* material held in the Western Australian Herbarium collections was examined for signs of ova of *E. nycteris*. One hatched eggshell was found on a *T. hirsuta* specimen collected near Beraking (32°10'S 116°24'E), southeast of Sawyer's Valley, suggesting the presence of *E. nycteris* at this locality.

Voucher specimens pertinent to this paper are lodged in the Insect Collection of the Western Australian Department of Conservation and Land Management and in Andrew Atkins' private collection. Food plant specimens have been lodged in the Western Australian Herbarium, Perth. Plant nomenclature follows Green (1985).

Acknowledgements

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NAME CHANGES TO AUSTRALASIAN *AEDES* MOSQUITOES (DIPTERA: CULICIDAE)

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Abstract

Recent taxonomic revision of the genus *Aedes* Meigen has resulted in changes to the scientific names of Australasian mosquitoes. An updated taxonomic list of 221 Australasian species formerly placed in *Aedes* is provided. Forty-one species remain in *Aedes*, 151 are referred to *Ochlerotatus* Lynch Arribalzaga and 29 are referred to *Verrallina* Theobald. Many common and medically important species are affected. The purpose of this paper is to alert the mosquito control community to the changes so that correct names are used.

Introduction

The genus *Aedes* Meigen has long been recognized as a large, hard-to-define group in need of revision (Belkin 1962). Recently, Reinert (1999, 2000) attempted to rearrange the genus into more natural groups. Reinert (1999) restored subgenus *Verrallina* Theobald to generic rank and revalidated subgenus *Neomacleaya* Theobald. Unfortunately, the transfer of species from *Aedes* (masculine) to *Verrallina* (feminine) results in changes to the spelling of specific names, as required by the International Code of Zoological Nomenclature. Reinert (2000) also raised subgenus *Ochlerotatus* Lynch Arribalzaga to generic rank. *Ochlerotatus* contains the following Australasian subgenera: *Chaetocruiomyia* Theobald, *Finlaya* Theobald, *Geoskusea* Edwards, *Halaedes* Belkin, *Macleaya* Theobald, *Molpemyia* Theobald, *Mucidus* Theobald, *Nothoskusea* Dumbleton, *Ochlerotatus*, *Pseudoskusea* Theobald and *Rhinoskusea* Edwards. Reinert (1999, 2000) proposed the abbreviations *Ve.* and *Oc.* for *Verrallina* and *Ochlerotatus*, respectively.

Systematic changes

Table 1 shows the new and old names of 221 species of Australasian mosquitoes formerly placed in *Aedes*. Forty-one species remain in *Aedes*, 151 are referred to *Ochlerotatus* and 29 are referred to *Verrallina*. These name changes will mainly affect mosquito and health professionals who need to use scientific names of mosquitoes in their work. Unfortunately, many medically important mosquito species are affected; for instance, the Ross River virus vectors *Oc. vigilax* (Skuse) and *Oc. camptorhynchus* (Thomson). However, other species such as the dengue vectors *Ae. aegypti* (Linnaeus) and *Ae. polynesiensis* Marks, occur within the subgenus *Stegomyia* Theobald and are not affected. Confusion due to taxonomic revision of *Aedes* will be minimised by speedy adoption of the new names by mosquito professionals. According to Reinert (2000) '... the creation of more natural and better defined genera are valid reasons for proposing this change and outweigh the initial inconvenience of the generic change of the affected species'.

Table 1. Old and new names for Australasian aedine mosquitoes due to Reinert (1999, 2000). All relevant species from the Australasian Region according to Debenham and Hicks (1989) are listed under 'old name' (excluding erroneously recorded species). Additions to this list are *Aedes wardangensis* Brust, Ballard, Driver, Hartley, Galway & Curran (Brust *et al.* 1998) and *Aedes pecuniosus* Edwards (Reinert 1993) and the resurrection of subgenus *Molpemyia* (Reinert 1993). Taxa with specific or subgeneric names that have changed and some common and medically important species are shown in bold.

Abbreviations: *Ae.* = *Aedes*; *Oc.* = *Ochlerotatus*; *Ve.* = *Verrallina*.

OLD NAME	NEW NAME
***Ae. (Aedimorphus) alboscutellatus* (Theobald)**	***Ae. (Aedimorphus) alboscutellatus* (Theobald)**
Ae. (Aedimorphus) caecus (Theobald)	*Ae. (Aedimorphus) caecus* (Theobald)
Ae. (Aedimorphus) lowisii (Theobald)	*Ae. (Aedimorphus) lowisii* (Theobald)
Ae. (Aedimorphus) nocturnus (Theobald)	*Ae. (Aedimorphus) nocturnus* (Theobald)
Ae. (Chaetocruiomyia) calabyi Marks	*Oc. (Chaetocruiomyia) calabyi* (Marks)
Ae. (Chaetocruiomyia) elchoensis Taylor	*Oc. (Chaetocruiomyia) elchoensis* (Taylor)
Ae. (Chaetocruiomyia) humeralis Edwards	*Oc. (Chaetocruiomyia) humeralis* (Edwards)
Ae. (Chaetocruiomyia) macmillani Marks	*Oc. (Chaetocruiomyia) macmillani* (Marks)
Ae. (Chaetocruiomyia) moloiensis Taylor	*Oc. (Chaetocruiomyia) moloiensis* (Taylor)
Ae. (Chaetocruiomyia) spinosipes Edwards	*Oc. (Chaetocruiomyia) spinosipes* (Edwards)
Ae. (Chaetocruiomyia) tulliae Taylor	*Oc. (Chaetocruiomyia) tulliae* (Taylor)
Ae. (Chaetocruiomyia) wattensis Taylor	*Oc. (Chaetocruiomyia) wattensis* (Taylor)
Ae. (Christophersiomyia) chionodes Belkin	*Ae. (Christophersiomyia) chionodes* Belkin
Ae. (Edwardsaedes) imprimens (Walker)	*Ae. (Edwardsaedes) imprimens* (Walker)
Ae. (Finlaya) albilabris Edwards	*Oc. (Finlaya) albilabris* (Edwards)
***Ae. (Finlaya) alboannulatus* (Macquart)**	***Oc. (Finlaya) alboannulatus* (Macquart)**
Ae. (Finlaya) alocasicola Marks	*Oc. (Finlaya) alocasicola* (Marks)
Ae. (Finlaya) alticola Bonne-Wepster	*Oc. (Finlaya) alticola* (Bonne-Wepster)
Ae. (Finlaya) anggiensis Bonne-Wepster	*Oc. (Finlaya) anggiensis* (Bonne-Wepster)
Ae. (Finlaya) argenteitarsis Brug	*Oc. (Finlaya) argenteitarsis* (Brug)
Ae. (Finlaya) argyronotum Belkin	*Oc. (Finlaya) argyronotum* (Belkin)

Ae. (Finlaya) aureostriatus (Doleschall)	*Oc. (Finlaya) aureostriatus* (Doleschall)
Ae. (Finlaya) australiensis (Theobald)	*Oc. (Finlaya) australiensis* (Theobald)
Ae. (Finlaya) avistylus Brug	*Oc. (Finlaya) avistylus* (Brug)
Ae. (Finlaya) biocellatus (Taylor)	*Oc. (Finlaya) biocellatus* (Taylor)
Ae. (Finlaya) bougainvillensis Marks	*Oc. (Finlaya) bougainvillensis* (Marks)
Ae. (Finlaya) britteni Marks & Hodgkin	*Oc. (Finlaya) britteni* (Marks & Hodgkin)
Ae. (Finlaya) burnetti Belkin	*Oc. (Finlaya) burnetti* (Belkin)
Ae. (Finlaya) buxtoni Belkin	*Oc. (Finlaya) buxtoni* (Belkin)
Ae. (Finlaya) candidoscutellum Marks	*Oc. (Finlaya) candidoscutellum* (Marks)
Ae. (Finlaya) clintoni Taylor	*Oc. (Finlaya) clintoni* (Taylor)
Ae. (Finlaya) derooki Brug	*Oc. (Finlaya) derooki* (Brug)
Ae. (Finlaya) dobodurus King & Hoogstraal	*Oc. (Finlaya) dobodurus* (King & Hoogstraal)
Ae. (Finlaya) dobrotworskyi Marks	*Oc. (Finlaya) dobrotworskyi* (Marks)
Ae. (Finlaya) fijiensis Marks	*Oc. (Finlaya) fijiensis* (Marks)
Ae. (Finlaya) flavipennis (Giles)	*Oc. (Finlaya) flavipennis* (Giles)
Ae. (Finlaya) franclemonti Belkin	*Oc. (Finlaya) franclemonti* (Belkin)
Ae. (Finlaya) freycinetiae Laird	*Oc. (Finlaya) freycinetiae* (Laird)
Ae. (Finlaya) fuscipalpis Belkin	*Oc. (Finlaya) fuscipalpis* (Belkin)
Ae. (Finlaya) fuscitarsis Belkin	*Oc. (Finlaya) fuscitarsis* (Belkin)
Ae. (Finlaya) gahnicola Marks	*Oc. (Finlaya) gahnicola* (Marks)
Ae. (Finlaya) gani Bonne-Wepster	*Oc. (Finlaya) gani* (Bonne-Wepster)
Ae. (Finlaya) gracilelineatus Bonne-Wepster	*Oc. (Finlaya) gracilelineatus* (Bonne-Wepster)
Ae. (Finlaya) hollandius King & Hoogstraal	*Oc. (Finlaya) hollandius* (King & Hoogstraal)
Ae. (Finlaya) hollingsheadi Belkin	*Oc. (Finlaya) hollingsheadi* (Belkin)
Ae. (Finlaya) horotoi Taylor	*Oc. (Finlaya) horotoi* (Taylor)
Ae. (Finlaya) iwi Marks	*Oc. (Finlaya) iwi* (Marks)
Ae. (Finlaya) josephinae Marks	*Oc. (Finlaya) josephinae* (Marks)
Ae. (Finlaya) keefei King & Hoogstraal	*Oc. (Finlaya) keefei* (King & Hoogstraal)
Ae. (Finlaya) knighti Stone & Bohart	*Oc. (Finlaya) knighti* (Stone & Bohart)
***Ae. (Finlaya) kochi* (Dönitz)**	***Oc. (Finlaya) kochi* (Dönitz)**
Ae. (Finlaya) lauriei (Carter)	*Oc. (Finlaya) lauriei* Carter
Ae. (Finlaya) mackerrasi Taylor	*Oc. (Finlaya) mackerrasi* (Taylor)
Ae. (Finlaya) maffii Taylor & Tenorio	*Oc. (Finlaya) maffii* (Taylor & Tenorio)
Ae. (Finlaya) mallochi Taylor	*Oc. (Finlaya) mallochi* (Taylor)
Ae. (Finlaya) milsoni Taylor	*Oc. (Finlaya) milsoni* (Taylor)

Ae. (Finlaya) monocellatus Marks	*Oc. (Finlaya) monocellatus* (Marks)
Ae. (Finlaya) neogeorgianus Belkin	*Oc. (Finlaya) neogeorgianus* (Belkin)
***Ae. (Finlaya) notoscriptus* (Skuse)**	***Oc. (Finlaya) notoscriptus* (Skuse)**
Ae. (Finlaya) novalbitarsis King & Hoogstraal	*Oc. (Finlaya) novalbitarsis* (King & Hoogstraal)
Ae. (Finlaya) occidentalis (Skuse)	*Oc. (Finlaya) occidentalis* (Skuse)
Ae. (Finlaya) oceanicus Belkin	*Oc. (Finlaya) oceanicus* (Belkin)
Ae. (Finlaya) palmarum Edwards	*Oc. (Finlaya) palmarum* (Edwards)
Ae. (Finlaya) papuensis (Taylor)	*Oc. (Finlaya) papuensis* (Taylor)
Ae. (Finlaya) plagosus Marks	*Oc. (Finlaya) plagosus* (Marks)
Ae. (Finlaya) plumiferus King & Hoogstraal	*Oc. (Finlaya) plumiferus* (King & Hoogstraal)
Ae. (Finlaya) quasirubithorax (Theobald)	*Oc. (Finlaya) quasirubithorax* (Theobald)
Ae. (Finlaya) quinquelineatus Edwards	*Oc. (Finlaya) quinquelineatus* (Edwards)
Ae. (Finlaya) roai Belkin	*Oc. (Finlaya) roai* (Belkin)
Ae. (Finlaya) rubiginosus Belkin	*Oc. (Finlaya) rubiginosus* (Belkin)
***Ae. (Finlaya) rubrithorax* (Macquart)**	***Oc. (Finlaya) rubrithorax* (Macquart)**
Ae. (Finlaya) rupestris Dobrotworsky	*Oc. (Finlaya) rupestris* (Dobrotworsky)
Ae. (Finlaya) samoanus (Grûnberg)	*Oc. (Finlaya) samoanus* (Grûnberg)
Ae. (Finlaya) schlosseri Belkin	*Oc. (Finlaya) schlosseri* (Belkin)
Ae. (Finlaya) shehzadae Qutubuddin	*Oc. (Finlaya) shehzadae* (Qutubuddin)
Ae. (Finlaya) solomonis Stone & Bohart	*Oc. (Finlaya) solomonis* (Stone & Bohart)
Ae. (Finlaya) stanleyi Peters	*Oc. (Finlaya) stanleyi* (Peters)
Ae. (Finlaya) subalbitarsis King & Hoogstraal	*Oc. (Finlaya) subalbitarsis* (King & Hoogstraal)
Ae. (Finlaya) subauridorsum Marks	*Oc. (Finlaya) subauridorsum* (Marks)
Ae. (Finlaya) subbasalis Dobrotworsky	*Oc. (Finlaya) subbasalis* (Dobrotworsky)
Ae. (Finlaya) toxopeusi Bonne-Wepster	*Oc. (Finlaya) toxopeusi* (Bonne-Wepster)
Ae. (Finlaya) tsiliensis King & Hoogstraal	*Oc. (Finlaya) tsiliensis* (King & Hoogstraal)
Ae. (Finlaya) tubbutiensis Dobrotworsky	*Oc. (Finlaya) tubbutiensis* (Dobrotworsky)
Ae. (Finlaya) tutuilae Ramalingam & Belkin	*Oc. (Finlaya) tutuilae* (Ramalingam & Belkin)
Ae. (Finlaya) wallacei Edwards	*Oc. (Finlaya) wallacei* (Edwards)
Ae. (Finlaya) wasselli Marks	*Oc. (Finlaya) wasselli* (Marks)
Ae. (Geoskusea) becki Belkin	*Oc. (Geoskusea) becki* (Belkin)

Ae. (Geoskusea) daggyi Stone & Bohart	*Oc. (Geoskusea) daggyi* (Stone & Bohart)
Ae. (Geoskusea) fimbripes Edwards	*Oc. (Geoskusea) fimbripes* (Edwards)
Ae. (Geoskusea) longiforceps Edwards	*Oc. (Geoskusea) longiforceps* (Edwards)
Ae. (Geoskusea) lunulatus King & Hoogstraal	*Oc. (Geoskusea) lunulatus* (King & Hoogstraal)
Ae. (Geoskusea) perryi Belkin	*Oc. (Geoskusea) perryi* (Belkin)
Ae. (Geoskusea) tonsus Edwards	*Oc. (Geoskusea) tonsus* (Edwards)
Ae. (Halaedes) ashworthi Edwards	*Oc. (Halaedes) ashworthi* (Edwards)
***Ae. (Halaedes) australis* (Erichson)**	***Oc. (Halaedes) australis* (Erichson)**
Ae. (Halaedes) wardangensis Brust *et al.*	*Oc. (Halaedes) wardangensis* (Brust *et al.*)
Ae. (Huaedes) medialis Brug	*Ae. (Huaedes) medialis* Brug
Ae. (Huaedes) variepictus King & Hoogstraal	*Ae. (Huaedes) variepictus* King & Hoogstraal
Ae. (Huaedes) wauensis Huang	*Ae. (Huaedes) wauensis* Huang
Ae. (Leptosomatomyia) aurimargo Edwards	*Ae. (Leptosomatomyia) aurimargo* Edwards
Ae. (Levua) suvae Stone & Bohart	*Oc. (Levua) suvae* (Stone & Bohart)
Ae. (?near *Levua) daliensis* (Taylor)	*Oc. (*?near *Levua) daliensis* (Taylor)
Ae. (Lorrainea) dasyorrhus King & Hoogstraal	*Ae. (Lorrainea) dasyorrhus* King & Hoogstraal
Ae. (Lorrainea) lamelliferus Bohart & Ingram	*Ae. (Lorrainea) lamelliferus* Bohart & Ingram
Ae. (Macleaya) littlechildi Taylor	*Oc. (Macleaya) littlechildi* (Taylor)
Ae. (Macleaya) stoneorum Marks	*Oc. (Macleaya) stoneorum* (Marks)
***Ae. (Macleaya) tremulus* (Theobald)**	***Oc. (Macleaya) tremulus* (Theobald)**
Ae. (Molpemyia) auridorsum Edwards	*Oc. (Molpemyia) auridorsum* (Edwards)
Ae. (Molpemyia) pecuniosus Edwards	*Oc. (Molpemyia) pecuniosus* (Edwards)
Ae. (Molpemyia) purpureus (Theobald)	*Oc. (Molpemyia) purpureus* (Theobald)
***Ae. (Mucidus) alternans* (Westwood)**	***Oc. (Mucidus) alternans* (Westwood)**
Ae. (Mucidus) aurantius aurantius (Theobald)	*Oc. (Mucidus) aurantius aurantius* (Theobald)
Ae. (Mucidus) aurantius chrysogaster (Taylor)	*Oc. (Mucidus) aurantius chrysogaster* (Taylor)
Ae. (Mucidus) painei Knight	*Oc. (Mucidus) painei* (Knight)
***Ae. (Neomelaniconion) lineatopennis* (Ludlow)**	***Ae. (Neomelaniconion) lineatopennis* (Ludlow)**
Ae. (Nothoskusea) chathamicus Dumbleton	*Oc. (Nothoskusea) chathamicus* (Dumbleton)

Ae. (Ochlerotatus) aculeatus (Theobald)	*Oc. (Ochlerotatus) aculeatus* (Theobald)
Ae. (Ochlerotatus) andersoni Edwards	*Oc. (Ochlerotatus) andersoni* (Edwards)
Ae. (Ochlerotatus) antipodeus (Edwards)	*Oc. (Ochlerotatus) antipodeus* Edwards
Ae. (Ochlerotatus) burpengaryensis (Theobald)	*Oc. (Ochlerotatus) burpengaryensis* (Theobald)
Ae. (Ochlerotatus) cacozelus Marks	*Oc. (Ochlerotatus) cacozelus* (Marks)
Ae. (Ochlerotatus) calcariae Marks	*Oc. (Ochlerotatus) calcariae* (Marks)
***Ae. (Ochlerotatus) camptorhynchus* (Thomson)**	***Oc. (Ochlerotatus) camptorhynchus* (Thomson)**
***Ae. (Ochlerotatus) clelandi* (Taylor)**	***Oc. (Ochlerotatus) clelandi* (Taylor)**
***Ae. (Ochlerotatus) continentalis* Dobrotworsky**	***Oc. (Ochlerotatus) continentalis* (Dobrotworsky)**
Ae. (Ochlerotatus) cunabulanus Edwards	*Oc. (Ochlerotatus) cunabulanus* (Edwards)
Ae. (Ochlerotatus) edgari Stone & Rosen	*Oc. (Ochlerotatus) edgari* (Stone & Rosen)
***Ae. (Ochlerotatus) eidsvoldensis* Mackerras**	***Oc. (Ochlerotatus) eidsvoldensis* (Mackerras)**
Ae. (Ochlerotatus) explorator Marks	*Oc. (Ochlerotatus) explorator* (Marks)
***Ae. (Ochlerotatus) flavifrons* (Skuse)**	***Oc. (Ochlerotatus) flavifrons* (Skuse)**
Ae. (Ochlerotatus) hesperonotius Marks	*Oc. (Ochlerotatus) hesperonotius* (Marks)
Ae. (Ochlerotatus) hodgkini Marks	*Oc. (Ochlerotatus) hodgkini* (Marks)
Ae. (Ochlerotatus) imperfectus Dobrotworsky	*Oc. (Ochlerotatus) imperfectus* (Dobrotworsky)
Ae. (Ochlerotatus) inexpectatus Bonne-Wepster	*Oc. (Ochlerotatus) inexpectatus* (Bonne-Wepster)
Ae. (Ochlerotatus) linesi Marks	*Oc. (Ochlerotatus) linesi* (Marks)
Ae. (Ochlerotatus) luteifemur Edwards	*Oc. (Ochlerotatus) luteifemur* (Edwards)
Ae. (Ochlerotatus) macintoshi Marks	*Oc. (Ochlerotatus) macintoshi* (Marks)
Ae. (Ochlerotatus) mcdonaldi Belkin	*Oc. (Ochlerotatus) mcdonaldi* (Belkin)
Ae. (Ochlerotatus) nigrithorax (Macquart)	*Oc. (Ochlerotatus) nigrithorax* (Macquart)
Ae. (Ochlerotatus) nivalis Edwards	*Oc. (Ochlerotatus) nivalis* (Edwards)
***Ae. (Ochlerotatus) normanensis* (Taylor)**	***Oc. (Ochlerotatus) normanensis* (Taylor)**
Ae. (Ochlerotatus) perkinsi Marks	*Oc. (Ochlerotatus) perkinsi* (Marks)
Ae. (Ochlerotatus) phaecasiatus Marks	*Oc. (Ochlerotatus) phaecasiatus* (Marks)
***Ae. (Ochlerotatus) procax* (Skuse)**	***Oc. (Ochlerotatus) procax* (Skuse)**
Ae. (Ochlerotatus) pseudonormanensis Marks	*Oc. (Ochlerotatus) pseudonormanensis* (Marks)

Ae. (Ochlerotatus) purpuraceus Brug	*Oc. (Ochlerotatus) purpuraceus* (Brug)
Ae. (Ochlerotatus) purpureifemur Marks	*Oc. (Ochlerotatus) purpureifemur* (Marks)
Ae. (Ochlerotatus) purpuriventris Edwards	*Oc. (Ochlerotatus) purpuriventris* (Edwards)
***Ae. (Ochlerotatus) ratcliffei* Marks**	***Oc. (Ochlerotatus) ratcliffei* (Marks)**
***Ae. (Ochlerotatus) sagax* (Skuse)**	***Oc. (Ochlerotatus) sagax* (Skuse)**
Ae. (Ochlerotatus) sapiens Marks	*Oc. (Ochlerotatus) sapiens* (Marks)
Ae. (Ochlerotatus) silvestris Dobrotworsky	*Oc. (Ochlerotatus) silvestris* (Dobrotworsky)
Ae. (Ochlerotatus) spilotus Marks	*Oc. (Ochlerotatus) spilotus* (Marks)
***Ae. (Ochlerotatus) stricklandi* (Edwards)**	***Oc. (Ochlerotatus) stricklandi* Edwards**
Ae. (Ochlerotatus) subalbirostris Klein & Marks	*Oc. (Ochlerotatus) subalbirostris* (Klein & Marks)
***Ae. (Ochlerotatus) theobaldi* (Taylor)**	***Oc. (Ochlerotatus) theobaldi* (Taylor)**
Ae. (Ochlerotatus) turneri Marks	*Oc. (Ochlerotatus) turneri* (Marks)
***Ae. (Ochlerotatus) vigilax* (Skuse)**	***Oc. (Ochlerotatus) vigilax* (Skuse)**
***Ae. (Ochlerotatus) vittiger* (Skuse)**	***Oc. (Ochlerotatus) vittiger* (Skuse)**
***Ae. (Pseudoskusea) bancroftianus* Edwards**	***Oc. (Pseudoskusea) bancroftianus* (Edwards)**
Ae. (Pseudoskusea) culiciformis (Theobald)	*Oc. (Pseudoskusea) culiciformis* (Theobald)
***Ae. (Pseudoskusea) multiplex* (Theobald)**	***Oc. (Pseudoskusea) multiplex* (Theobald)**
Ae. (Pseudoskusea) postspiraculosis Dobrotworsky	*Oc. (Pseudoskusea) postspiraculosis* (Dobrotworsky)
Ae. (Rhinoskusea) longirostris (Leicester)	*Oc. (Rhinoskusea) longirostris* (Leicester)
Ae. (Scutomyia) albolineatus (Theobald)	*Ae. (Scutomyia) albolineatus* (Theobald)
***Ae. (Stegomyia) aegypti* (Linnaeus)**	***Ae. (Stegomyia) aegypti* (Linnaeus)**
***Ae. (Stegomyia) albopictus* (Skuse)**	***Ae. (Stegomyia) albopictus* (Skuse)**
Ae. (Stegomyia) annandalei (Theobald)	*Ae. (Stegomyia) annandalei* (Theobald)
Ae. (Stegomyia) aobae Belkin	*Ae. (Stegomyia) aobae* Belkin
Ae. (Stegomyia) cooki Belkin	*Ae. (Stegomyia) cooki* Belkin
Ae. (Stegomyia) futunae Belkin	*Ae. (Stegomyia) futunae* Belkin
Ae. (Stegomyia) gurneyi Stone & Bohart	*Ae. (Stegomyia) gurneyi* Stone & Bohart
Ae. (Stegomyia) hebrideus Edwards	*Ae. (Stegomyia) hebrideus* Edwards
Ae. (Stegomyia) hensilli Farner	*Ae. (Stegomyia) hensilli* Farner
Ae. (Stegomyia) hoguei Belkin	*Ae. (Stegomyia) hoguei* Belkin

Ae. (Stegomyia) horrescens Edwards	*Ae. (Stegomyia) horrescens* Edwards
Ae. (Stegomyia) katherinensis Woodhill	*Ae. (Stegomyia) katherinensis* Woodhill
Ae. (Stegomyia) kesseli Huang & Hitchcock	*Ae. (Stegomyia) kesseli* Huang & Hitchcock
Ae. (Stegomyia) marshallensis Stone & Bohart	*Ae. (Stegomyia) marshallensis* Stone & Bohart
Ae. (Stegomyia) paullusi Stone & Farner	*Ae. (Stegomyia) paullusi* Stone & Farner
Ae. (Stegomyia) pernotatus Farner & Bohart	*Ae. (Stegomyia) pernotatus* Farner & Bohart
***Ae. (Stegomyia) polynesiensis* Marks**	***Ae. (Stegomyia) polynesiensis* Marks**
***Ae. (Stegomyia) pseudoscutellaris* (Theobald)**	***Ae. (Stegomyia) pseudoscutellaris* (Theobald)**
Ae. (Stegomyia) quasiscutellaris Farner & Bohart	*Ae. (Stegomyia) quasiscutellaris* Farner & Bohart
Ae. (Stegomyia) robinsoni Belkin	*Ae. (Stegomyia) robinsoni* Belkin
Ae. (Stegomyia) rotumae Belkin	*Ae. (Stegomyia) rotumae* Belkin
***Ae. (Stegomyia) scutellaris* (Walker)**	***Ae. (Stegomyia) scutellaris* (Walker)**
Ae. (Stegomyia) tabu Ramalingam & Belkin	*Ae. (Stegomyia) tabu* Ramalingam & Belkin
Ae. (Stegomyia) tongae Edwards	*Ae. (Stegomyia) tongae* Edwards
Ae. (Stegomyia) tulagiensis Edwards	*Ae. (Stegomyia) tulagiensis* Edwards
Ae. (Stegomyia) upolensis Marks	*Ae. (Stegomyia) upolensis* Marks
Ae. (Stegomyia) varuae Belkin	*Ae. (Stegomyia) varuae* Belkin
***Ae. (Verrallina) azureosquamatus* Bonne-Wepster**	***Ve. (Verrallina) azureosquamata* (Bonne-Wepster)**
***Ae. (Verrallina) bifoliatus* King & Hoogstraal**	***Ve. (Verrallina) bifoliata* (King & Hoogstraal)**
Ae. (Verrallina) butleri Theobald	*Ve. (Verrallina) butleri* (Theobald)
***Ae. (Verrallina) campylostylus* Laffoon**	***Ve. (Neomacleaya) campylostylus* (Laffoon)**
***Ae. (Verrallina) carmenti* Edwards**	***Ve. (Verrallina) carmenti* (Edwards)**
Ae. (Verrallina) cuccioi Belkin	*Ve. (Verrallina) cuccioi* (Belkin)
Ae. (Verrallina) cunninghami Taylor	*Ve. (Verrallina) cunninghami* (Taylor)
Ae. (Verrallina) embiensis Huang	*Ve. (Verrallina) embiensis* (Huang)
Ae. (Verrallina) foliformis King & Hoogstraal	*Ve. (Verrallina) foliformis* (King & Hoogstraal)
***Ae. (Verrallina) funereus* (Theobald)**	***Ve. (Verrallina) funerea* (Theobald)**
Ae. (Verrallina) killertonis Huang	*Ve. (Verrallina) killertonis* (Huang)
Ae. (Verrallina) leilae King & Hoogstraal	*Ve. (Verrallina) leilae* (King & Hoogstraal)

***Ae. (Verrallina) lineatus* (Taylor)**	***Ve. (Verrallina) lineata* (Taylor)**
Ae. (Verrallina) mccormicki Belkin	*Ve. (Verrallina) mccormicki* (Belkin)
Ae. (Verrallina) milnensis King & Hoogstraal	*Ve. (Verrallina) milnensis* (King & Hoogstraal)
Ae. (Verrallina) multifolium King & Hoogstraal	*Ve. (Verrallina) multifolium* (King & Hoogstraal)
***Ae. (Verrallina) neomacrodixoa* King & Hoogstraal**	***Ve. (Neomacleaya) neomacrodixoa* (King & Hoogstraal)**
***Ae. (Verrallina) obsoletus* Huang**	***Ve. (Verrallina) obsoleta* (Huang)**
***Ae. (Verrallina) panayensis* Ludlow**	***Ve. (Neomacleaya) panayensis* (Ludlow)**
Ae. (Verrallina) parasimilis King & Hoogstraal	*Ve. (Verrallina) parasimilis* (King & Hoogstraal)
Ae. (Verrallina) quadrifolium Brug	*Ve. (Verrallina) quadrifolium* (Brug)
***Ae. (Verrallina) quadrispinatus* King & Hoogstraal**	***Ve. (Verrallina) quadrispinata* (King & Hoogstraal)**
Ae. (Verrallina) reesi King & Hoogstraal	*Ve. (Verrallina) reesi* (King & Hoogstraal)
***Ae. (Verrallina) sentanius* King & Hoogstraal**	***Ve. (Verrallina) sentania* (King & Hoogstraal)**
Ae. (Verrallina) similis (Theobald)	*Ve. (Verrallina) similis* (Theobald)
Ae. (Verrallina) simplus King & Hoogstraal	*Ve. (Verrallina) simplus* (King & Hoogstraal)
***Ae. (Verrallina) trispinatus* King & Hoogstraal**	***Ve. (Verrallina) trispinata* (King & Hoogstraal)**
***Ae. (Verrallina) vanapus* Huang**	***Ve. (Verrallina) vanapa* (Huang)**
Ae. (Verrallina) variabilis Huang	*Ve. (Verrallina) variabilis* (Huang)

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PARASITISM OF *EYSARCORIS TRIMACULATUS* (DISTANT) (HEMIPTERA: PENTATOMIDAE) BY TWO TACHINID FLIES (DIPTERA: TACHINIDAE)

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Abstract

Cylindromyia expansa Cantrell and *Alophora (Mormonomyia)* sp. are recorded parasitising *Eysarcoris trimaculatus* (Distant) adults in the Burdekin River Irrigation Area of northern Queensland. Parasitism rates ranged from 0-16% and parasitism was recorded in most months of the year.

Introduction

There are few records of parasitism of adult or nymphal Australian pentatomid bugs by flies in the family Tachinidae. Cantrell (1984, 1986) reported records of *Cylindromyia rufifemur* Paramov from two species of Pentatomidae, while Coombs and Khan (1997) provided host/parasitoid records for five species of Pentatomidae and seven species of Tachinidae. These authors commented on the paucity of such records.

Eysarcoris trimaculatus (Distant) is a small, brownish bug found in Western Australia, Northern Territory, Queensland and New South Wales (Wood and McDonald 1984). It is a pest of rice (Learmonth 1980, Halfpapp *et al.* 1992). Kay (1993) studied its developmental biology and occurrence in rice fields in northern Queensland. Records of parasitism of adult *E. trimaculatus* by tachinid flies noted during that study are reported here.

Materials and methods

Adult *E. trimaculatus* were collected from rice (*Oryza sativa* L.) or from stands of mixed weeds, including barnyard grass (*Echinochloa colona* (L.) Link), sedges (*Cyperus* spp.) and rice grass (*Leersia hexandra* Sw.), on which they also feed (Kay 1993). Collections were made with a sweep net on three occasions during 1987 near Clare (19°47'S, 147°13'E) in the Burdekin River Irrigation Area. The bugs were held in the laboratory and provided with rice panicles for food. They were checked every two days until parasitoids emerged or they died, with all dead bugs dissected. Several parasitoid pupae were collected on the day they appeared in the holding containers and were held at 24.5°C with a 14:12 L:D photoperiod until adults emerged. The parasitoids were identified. A total of 86 fifth (final) instar *E. trimaculatus* nymphs in lots of from three to 25 were collected from the field near Clare at various times from March 1987 to May 1988 and held in the laboratory until they developed to adults, which took from 1-7 days (mean 3.85 days).

From February 1987 to January 1988 twelve monthly collections of *E. trimaculatus* adults were made at Clare from rice and weeds. Females were

dissected to determine their reproductive status (Kay 1993). The number of females found to contain parasitoid larvae was recorded.

Results

Two species of Tachinidae, both in the subfamily Phasiinae, were reared from *E. trimaculatus* adults. They were *Cylindromyia expansa* Cantrell and *Alophora (Mormonomyia)* sp. Seven *C. expansa* and one *Alophora* sp. were reared from 49 adult *E. trimaculatus* collected in early March, four *C. expansa* emerged from 149 adult *E. trimaculatus* in mid May and one *Alophora* sp. emerged from 84 adult *E. trimaculatus* in mid June. Specimens are held in the QDPI Insect Collection, Brisbane, under the following Accession Numbers: *C. expansa* K2927 and K2928; *Alophora* sp. K2922 and K2929. (Also, specimens of adult *Alophora* sp. collected with a sweep net in rice stubble at Clare in June 1987 are held under the numbers K2923 and K2924.) No parasitoids emerged from the field-collected nymphs.

Both *C. expansa* and *Alophora* sp. emerged from the host as larvae and pupated externally as their pupae were found in the holding container. Parasitised bugs dissected after death were found to be hollow shells with the thorax and abdomen completely empty. The numbers of parasitised *E. trimaculatus* corresponded to the number of parasitoid pupae recovered indicating that only one parasitoid developed in each host. *C. expansa* adults emerged in 10-11 days from pupae held at 24.5°C.

Parasitoid larvae were found in some female *E. trimaculatus* that were dissected to determine their reproductive status. The identity of the parasitoids is not known, but probably they were one or both of the tachinids recorded. The percentage parasitism rates for each collection date (1987 unless stated otherwise) and the number of female *E. trimaculatus* dissected (n) were: 17 February 1.7% (58); 10 March 4.0% (25); 23 April 4.0% (99); 21 May 6.9% (29); 23 June 0% (79); 23 July 0% (7); 18 August 0% (13); 22 September 10.7% (28); 21 October 3.7% (54); 25 November 5.3% (38); 23 December 2.0% (49); 25 January 1988 0% (66).

Discussion

Two more host/parasitoid records for Australian pentatomids/tachinids are added to those few previously known (Cantrell 1984, 1986, Coombs and Khan 1997). This is the first host record for *C. expansa*. While there are several Australian records of hemipterous insects as hosts of species of *Alophora* (Cantrell 1986, Coombs and Khan 1997), Cantrell (1984) pointed out that the Australian species of *Alophora* were in need of a thorough review. The exact identity of the *Alophora* species and their host/parasitoid relationships will remain undetermined until the review is done.

While these are the first parasitoids recorded from an Australian species of *Eysarcoris* Hahn there are records of parasitism of members of the genus by tachinids from other regions of the world. Cheema *et al.* (1973) reared two

tachinids (*Plesiocyptera evibrissata* Townsend and *Preeuthera tuckeri* Bezzi) from adult *Eysarcoris inconspicuus* Herrich-Schäffer and found unidentified tachinid larvae in *E. inconspicuus*, *Eysarcoris guttiger* Thunberg and *Eysarcoris modestus* Distant in Pakistan. In Japan, the tachinid *Gymnosoma rotundatum* L. was recorded from nymphs and adults of *Eysarcoris ventralis* (Westwood) and *Eysarcoris lewisi* (Scott), while an unidentified fly parasitised *Eysarcoris parvus* Uhler (Ito 1978, Nakazawa and Hayashi 1984). Richter and Markova (1999) reared *Cylindromyia umbripennis* van der Wulp from *Eysarcoris aeneus* (Scopoli) in Russia.

This study provided limited biological and ecological information on the parasitoids. One parasitoid developed in each host. As *E. trimaculatus* are small bugs (adults are approximately 5 mm long by 3 mm wide), it is likely that they are able to support the development of only one parasitoid to maturity. Parasitism rates of adult *E. trimaculatus*, as determined by rearing and dissection, were low, ranging from 0-16%, similar to rates reported by Cheema *et al.* (1973) for *Eysarcoris* spp. in Pakistan (0.4-12.5%) but lower than that due to *G. rotundatum* in Japan, which averaged 20% (Nakazawa and Hayashi 1984). No parasitoids were reared from *E. trimaculatus* nymphs but this may simply reflect the low numbers collected on any one day. Cheema *et al.* (1973) commented that parasitism of *Eysarcoris* spp. nymphs in Pakistan was extremely rare, while Nakazawa and Hayashi (1984) reported that *G. rotundatum* commonly parasitised both nymphs and adults in Japan but that it preferred to oviposit in adults rather than nymphs. More extensive collecting and rearing of *E. trimaculatus* nymphs is needed to determine if the tachinids will parasitise them. The duration of the pupal stage of *C. expansa* is 10-11 days at 24.5°C. The rearing and dissection data indicate that the parasitoids were active for most of the year, although no parasitised *E. trimaculatus* were recorded in July and August, during the district's mild, dry winter. It is not known whether the lack of recorded parasitism in July and August reflects a lack of activity by the parasitoids during winter or that parasitism rates were too low to be recorded. *E. trimaculatus* adults and nymphs were scarce and occurred on scattered, isolated patches of weeds in moist areas during those months (Kay 1993).

Acknowledgements

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THRIPS (THYSANOPTERA) AS A PUBLIC NUISANCE: A QUEENSLAND CASE STUDY AND OVERVIEW, WITH COMMENTS ON HOST PLANT RELATIONSHIPS

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Abstract

Pseudanaphothrips araucariae Mound & Palmer, an Australian endemic, is reported breeding in the male cones of introduced *Pinus* in such high numbers that it caused public health problems by invading a school. Information is summarised on other thrips causing a public nuisance. This problem is considered in the light of intra-generic host-shifting and behavioural opportunism amongst some thrips species.

Introduction

During the last week of July 2000, the Tropical Public Health Unit in Cairns was contacted about a plague of minute insects affecting a school near Cardwell, northern Queensland. Children were distressed because of massive numbers of tiny insects getting onto their skin and into their hair, eyes and mouth. Some children claimed to have been bitten. However, despite active surveillance by school staff and parents, few children were found to have any welts indicative of an allergic reaction. The insects also got into food, making outdoor eating impossible.

The school was forced to restrict outside activity to the period before 1130 h, when the insect numbers were tolerable. The plague became severe after that time, continuing through the afternoon. It only abated in the evening with cooler temperatures. Enormous numbers of these insects collected on walls and ledges inside classrooms, having entered readily through open doors and windows. Overhead fans in the classrooms did not prove effective in reducing the problem, although conditions were satisfactory when all doors and windows were closed and the air-conditioning turned on.

A plantation of pine trees (*Pinus caribaea*) surrounded the school. These trees were thought to be the probable source of the insects but, in the absence of more definite information, insecticide treatment was not considered appropriate. The plague had occurred in previous years, starting early in July after pollen drop in the pine trees. In 2000, the outbreak was preceded by three months of dry weather. Rainfall from May to July was 45% of normal, with only 3.2 mm of rain in July. Rains in early August (43 mm from 1-9 August), while not having an immediate effect, were considered to have contributed to the subsequent decline in numbers, such that the outbreak was over by 10 August.

The insects causing the problem at this school were identified subsequently as a species of thrips in the family Thripidae, *Pseudanaphothrips araucariae* Mound & Palmer. This is a native Australian species that was described originally as breeding in the male cones of *Araucaria bidwilli* in southern Queensland (Mound and Palmer 1990). However, in describing the thrips species, the authors also recorded it from the male cones of *Araucaria heterophylla* in the Hawaiian Islands, whence presumably it had been introduced.

More recently, this thrips was found by the Queensland Department of Primary Industries Forestry staff to be breeding in the male cones of *Pinus tecunumanii* in the seed orchard at Cardwell. It occurred in such large numbers in these cones that fears were being expressed that it might reduce the pollen yield below critical levels. DPI Forestry staff reported that the thrips swarmed all over them, but that they were not bitten. The only other available records of this thrips are also from DPI Forestry staff, who have twice found it in large numbers at Imbil, southern Queensland, on *Araucaria cookii* male cones (28.xi.1979) and on *Araucaria cunninghamii* male cones (1.ii.2001). Apart from these records nothing further is known about this insect but reports of thrips as a public nuisance when in large populations are more extensively documented.

Thrips as a public nuisance

The standard textbook on medical insects (Lane and Crosskey 1995) refers to several species of thrips being of minor medical importance, but the data in the book is derived largely from R.V. Southcott, a medical practitioner in Adelaide, South Australia. Southcott (1986) published several personal observations on thrips attacks in Adelaide, together with a summary of a number of previously published comments. One of these concerned the late C.B. Williams who, many years ago in London, recounted to one of us (LAM) an experiment carried out during his youth in Trinidad. He allowed a thrips of the family Phlaeothripidae, *Karnyothrips flavipes* (Jones), a scale insect predator, to suck blood from his wrist over a period of 30 minutes.

A rather similar thrips, *Haplothrips froggatti* Hood, the Black Plague Thrips of Australia, causes occasional annoyance in dry areas. This species breeds in grasses and in years of good grass growth the populations of thrips increase dramatically, with mass flights occurring during subsequent dry weather. Vast numbers of this thrips then disperse and enter houses as well as crops. Mass emergences of this sort were reported during the year 2000 in parts of Queensland and Northern Territory, following the dry weather that occurred that year.

A third member of the family Phlaeothripidae that causes recurrent problems is *Gynaikothrips ficorum* (Marchal). This thrips induces leaf-roll galls on *Ficus microcarpa*, a tree that is widely planted throughout tropical and

subtropical countries. In Latin America, where these trees are common in town and village squares, local residents relaxing in their shade can be plagued by this thrips getting into their eyes and glasses of beer. The tree is widely planted in gardens around Australia, the thrips being reported occasionally as a local irritant in parts of New South Wales (Peter Gillespie, pers. comm.).

Amongst the members of the Thripidae, the other large family of Thysanoptera, *Limothrips cerealium* (Haliday) is the most frequently recorded species causing irritation. In Western Europe, this species frequently probes sweaty skin on stormy summer days, when the adults emerge from their cereal hosts in mass flights. This habit has earned the species the common name 'Thunder Fly'. Other species of Thripidae that occur in large numbers and have been noted to cause problems of skin irritation through the probing of adults, are *Frankliniella bispinosa* (Morgan) in Florida, *Thrips tabaci* Lindeman in California, *Thrips major* Uzel in Germany and *Thrips imaginis* Bagnall in South Australia. According to Southcott (1986), the earliest published record of thrips causing irritation was from Paris in 1902, the species involved being *Melanthrips fuscus* (Sulzer), a common member of the Melanthripidae.

Mass flights of thrips also give rise to complaints, in various countries, of freshly laundered clothes being soiled whilst drying. This is a common problem in southern Australia with the Plague Thrips, *Thrips imaginis*. A more serious effect of these mass flights is the nuisance caused by large numbers of adults triggering smoke-detector fire alarms (Lewis 1997), thus causing considerable distress in hospitals and old peoples' homes. This is particularly important with *Limothrips cerealium* in Western Europe, a species notorious for its thigmotactic behaviour. Each summer adults crawl into minute spaces to over-winter. They can then be found in many unlikely situations, the following being some of the places noted during routine identifications over many years: under glass of framed pictures, in backs of brooches in museums, inside stored polystyrene blocks intended for building insulation, within factory sealed hypodermic syringes and tampons, and on tissue cultures in sterile laboratories with a double-scrubbed air supply.

Intra-generic host-plant diversity

This record of a *Pseudanaphothrips* species becoming a public nuisance draws attention to the interesting biological phenomenon of host-shifting. Biologists commonly expect that species within a single genus will exhibit similar biological characteristics, such that congeneric species are commonly predicted to breed on host plants that are related to each other. There are several examples of such host-relationships amongst Australian Thysanoptera, including *Dichromothrips* species in the flowers of orchids, *Odontothripiella* species in pea flowers and several genera of Phlaeothripidae on *Acacia*

phyllodes. In contrast, host-exploitation in some genera such as *Pseudanaphothrips* is more opportunistic and unpredictable.

Pseudanaphothrips achaetus (Bagnall) is a widespread flower-thrips in Australia, apparently breeding in a very wide range of flowers. In contrast, recent field-work has established that five of the 14 named species in the genus (Mound 1996) are specific to remarkably different plants: *P. araucariae* in male cones of Pinopsida; *P. casuarinae* Mound & Palmer in male cones of various Casuarinaceae; *P. frankstoni* (Steele) on fertile fronds of *Dicksonia antarctica* (Filicopsida); *P. melanurus* (Steele) in flowers of *Cassinia* (Asteraceae); *P. annettae* Mound & Palmer on leaves of several small *Leucopogon* species (Epacridaceae).

Irregular and opportunistic patterns of host exploitation are rarely studied. They are less susceptible to investigation than patterns that exhibit regularity. But the evolution of several species of pest thrips derives from their opportunistic behaviour (Mound and Teulon 1995), with radical changes in host-plant associations as well as changes from phytophagy to predation. *P. araucariae* is an endemic Australian thrips, yet it now breeds in large numbers on one or more exotic *Pinus* species. Given the flexibility in behaviour that must underlie such opportunism, perhaps it should not come as a surprise that such a species indulges occasionally in thalophagy. However, any thrips species that occurs in very large numbers seems likely to have the potential to cause irritation to humans.

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NEW BUTTERFLY TAXA FROM NEW IRELAND, PAPUA NEW GUINEA (LEPIDOPTERA: NYMPHALIDAE AND LYCAENIDAE)

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Abstract

Parantica fuscela berak subsp. nov., *Nacaduba zaron* sp. nov, *Philiris siassi krima* subsp. nov., *P. apicalis ginni* subsp. nov., *P. luscescens lak* subsp. nov. and *Udara drucei tennenti* subsp. nov. from New Ireland are described and illustrated. The life history of *P. siassi krima* is also described and figured, with *Litsea* sp. (Lauraceae) recorded as a larval food plant.

Introduction

A number of new butterfly taxa have been described recently from New Ireland, Papua New Guinea (Müller 1999a, 1999b, 2001; Müller and Sands 1999; Müller and Tennent 1999; Tennent 2000a, 2000b). The majority of these were taken in largely inaccessible montane rainforest in the interior of the island. This work describes further new taxa from New Ireland, including one new species and five distinctive new subspecies of little-known taxa recorded previously only from New Britain, Umboi Island or mainland New Guinea.

Depositories are abbreviated as follows: AMS - Australian Museum, Sydney; ANIC - Australian National Insect Collection, CSIRO, Canberra; BMNH - The Natural History Museum, London; CJMC - C. J. Müller Collection; SGC - Scott Ginn Collection.

Parantica fuscela berak subsp. nov.

(Figs 1-4)

Types. Holotype ♂, PAPUA NEW GUINEA: Hans Meyer Range, 1400 m, southern New Ireland, 24.viii.1998, C.J. Müller (BMNH). *Paratypes*: 1 ♂, same data as holotype (CJMC), 1 ♀, same data as holotype (BMNH), 1 ♀, Hans Meyer Range, 2400 m, southern New Ireland, 22.viii.1998, C.J. Müller (CJMC).

Description. Male (Figs 1-2). Forewing length 39 mm; antenna 18 mm. Head black with white dots around eye, both dorsally and ventrally; antenna and labial palpus black. Thorax black. Abdomen black dorsally and grey-cream ventrally. Forewing upperside deep chocolate brown with a bluish-white median cell spot, a number of irregular postmedian, subapical and subterminal spots of similar colouring between vein CuA_2 and costa; underside similar to upperside but with ground colour more red-brown close to termen and along costa. Hindwing with subtornal grey oval sex brand centered on vein 1A+2A, upperside light chocolate brown with irregular bluish-white median band and more distinct submarginal row of spots; underside similar to upperside but with ground colour red-brown, distinct white spot in radial sector and a row of white submarginal spots, black scaling around sex brand.

Female (Figs 3-4). Forewing length 42 mm, antenna 19 mm. Simlar to male but larger, with wings more rounded, ground colour on both wing surfaces paler, submarginal and median forewing spots extended to near anal vein, underside with submarginal row of spots larger and more continuous.

Comments. Both sexes of *P. f. berak* may be separated from *P. f. fuscela* Parsons by the larger bluish-white spots on both wing surfaces and by the presence of a row of white subterminal spots on the hindwing underside. The underside ground colour in *P. f. berak* appears to be a much richer red-brown than that of *P. f. fuscela*, although the only known pair of the latter taxon are worn and this may not be a diagnostic character.

Parantica f. fuscela was described from a single pair, taken during the early 1960s by J. Sedlacek in eastern New Britain, at about 1000 m elevation (Parsons 1989). The discovery of this species in montane New Ireland is not surprising, considering the faunal similarities between the two islands. Adults of *P. f. berak* were taken flying in montane moss forest together with a number of recently described montane taxa, including *Graphim kosii* Müller & Tennent, *Cethosia vasilia* Müller, *Delias messalina lizzae* Müller, *Leuciacria olivei* Müller and *Mycalesis mulleri* Tennent.

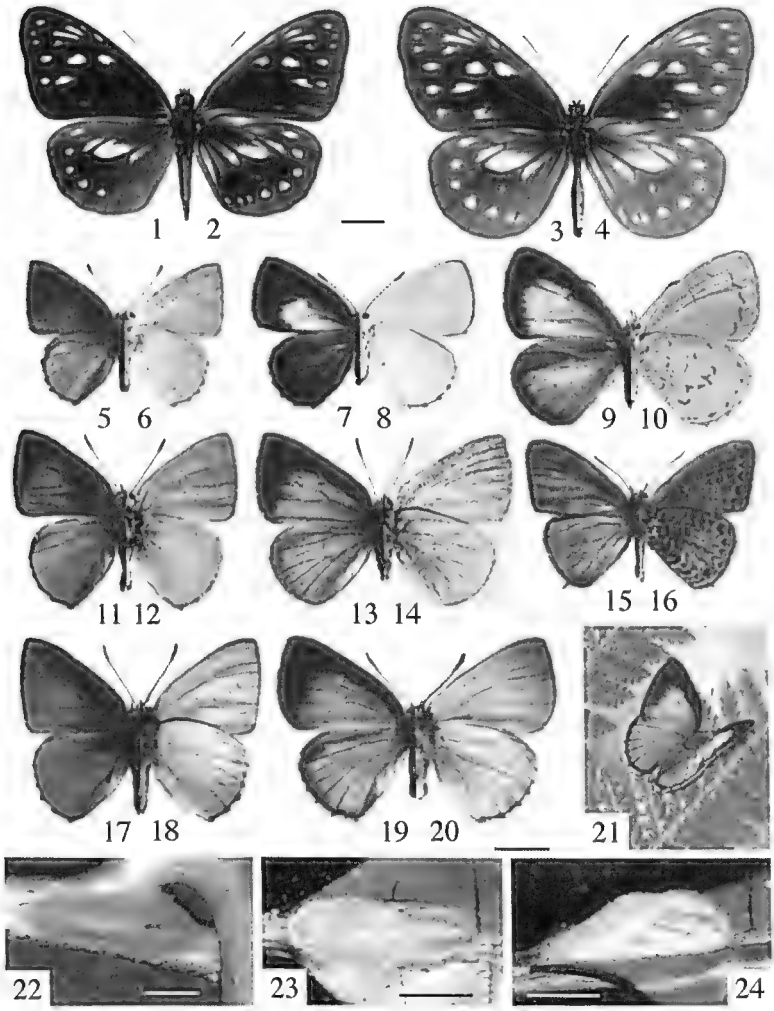
Philiris siassi krima subsp. nov.

(Figs 13-14, 17-24)

Types. *Holotype* ♂, PAPUA NEW GUINEA: Cape Suesat, 50 m, northeastern New Ireland, 15.vii.1998, C.J. Müller (ANIC). *Paratypes*: 1 ♂, same data as holotype (CJMC), 1 ♂, same data as holotype but dated 17.vii.1998 (AMS), 4 ♂♂, ~12 km W of Taron Village, 550 m, southern New Ireland, 14.viii.1998, C.J. Müller (1 in BMNH, 3 in CJMC), 1 ♂, Weiten Valley, 350 m, southern New Ireland, 24.viii.1998, C.J. Müller (CJMC), 1 ♂, Schleinitz Mts, 900 m, central New Ireland, 8.x.2000, C.J. Müller (CJMC), 2 ♀♀, Schleinitz Mts, 1260 m, central New Ireland, 24.vii.1998, C. J. Müller (CJMC), 1 ♀, Schleinitz Mts, 1000 m, central New Ireland, bred ex-pupa, emerged 24.xi.2000, pupated 1.xi.2000, C.J. Müller (CJMC).

Description. Male (Figs 17-18). Forewing length 19 mm, antenna 10 mm. Head black with eye ringed white; antenna black, ringed white, with club tipped orange brown. Thorax black dorsally and grey ventrally. Abdomen black, white ventrally. Forewing with costa fairly straight; upperside purplish-blue with narrow (< 0.5 mm) black termen; underside lustrous white. Hindwing upperside as for forewing but with costa and inner margin broadly grey-brown; underside as for forewing but with narrow black border, increasing in width towards tornus.

Female (Figs 13-14, 19-20). Forewing length 20 mm, antenna 11 mm. Head, antenna, thorax and abdomen as for male. Forewing with termen strongly convex; upperside black-brown with iridescent sky blue area extending from base through cell along radius to postmedian area and to inner margin; underside as for male. Hindwing upperside sky blue with black-brown termen



Figs 1-24. New butterfly taxa from New Ireland. (1-20): Adults; odd numbers upperside, even numbers underside. (1, 2) *Parantica fuscela berak* male; (3, 4) *P. f. berak* female; (5, 6) *Philiris luscescens lak* male; (7, 8) *P. l. lak* female; (9, 10) *Udara drucei tennenti* female; (11, 12) *Philiris apicalis ginni* male; (13, 14) *P. siassi krima* female; (15, 16) *Nacaduba zaron* male; (17, 18) *Philiris siassi krima* male; (19, 20) *P. s. krima* female. (21): *P. s. krima* female, on foliage. (22-24): Early stages of *P. s. krima*. (22) Fifth instar larva, dorsal view; (23) Pupa, dorsal view; (24) Pupa, lateral view. Scale bar (Figs 1-4) = 9 mm; (Figs 5-20) = 8 mm; (Figs 22-24) = 6 mm.

border, also extending along veins, broadly grey-brown along costa and inner margin, cilia white; underside as for male.

Life history. Foodplant *Litsea* sp. (Lauraceae).

Egg. Diameter 0.8 mm, wider than high, white, strongly pitted with fine spines along pit peripheries.

Larva (Fig. 22). Third instar 14 mm long, flattened laterally, flanged and indented between segments, dense fine setae covering body, especially anteriorly, grass green with pair of irregular yellow dorsolateral stripes and light brown dorsal stripe along segments 1 and 2, also 8 and 9. Final instar (Fig. 22) 23 mm long, similar to third instar but with dark dorsal stripe blue-black and restricted to body segments 1 and 2.

Pupa (Figs 23-24). Length 16 mm, covered by short, coarse setae, flattened posteriorly, pale yellow-green with red-brown dorsal stripe on head and thorax and 3 equidistant stripes of similar colouring on wing cases, parallel to veins, and along termen. Attached by cremaster and central girdle.

Comments. *P. s. krima* males are very similar to those of *P. s. siassi* Sands but tend to have a straighter forewing termen, giving the wings a more pointed appearance. The male genitalia are very similar to those of *P. s. siassi* (see Sands 1979). Females have the blue area on the upperside much more extensive and paler than in *P. s. siassi*. Females are variable in wing shape (see Figs 13-14, 19-20).

Philiris s. siassi was described from specimens taken from Umboi (Siassi) Island in the Bismarck archipelago (Sands 1979). Specimens have also been observed on New Britain (D. Sands, pers. comm.). In New Ireland *P. s. krima* occurs from sea level to around 1300 m and possibly higher. Males defend territories from perches between 3 and 12 m above the ground, commonly adjacent to streams. At low altitude in southern New Ireland this species was taken flying with *Philiris melanacra* Tite, *P. tombara* Tite, *P. luscescens lak* and *P. intensa* (Butler).

Philiris luscescens lak subsp. nov.

(Figs 5-8, 26)

Types. *Holotype* ♂, PAPUA NEW GUINEA: ~6 km N of Cape Silur, 100-150 m, southern New Ireland, 3.viii.1998, C.J. Müller (ANIC). *Paratypes*: 1 ♂, 1 ♀, same data as holotype but dated 5.viii.1998, genitalia dissected and attached to specimen (CJMC), 1 ♂, 1 ♀, same data as holotype but dated 8.viii.1998 (CJMC), 1 ♂, same data as holotype but dated 9.viii.1998 (AMS), 1 ♂, same data as holotype but dated 10.viii.1998 (CJMC), 1 ♂, same data as holotype but dated 11.viii.1998 (CJMC).

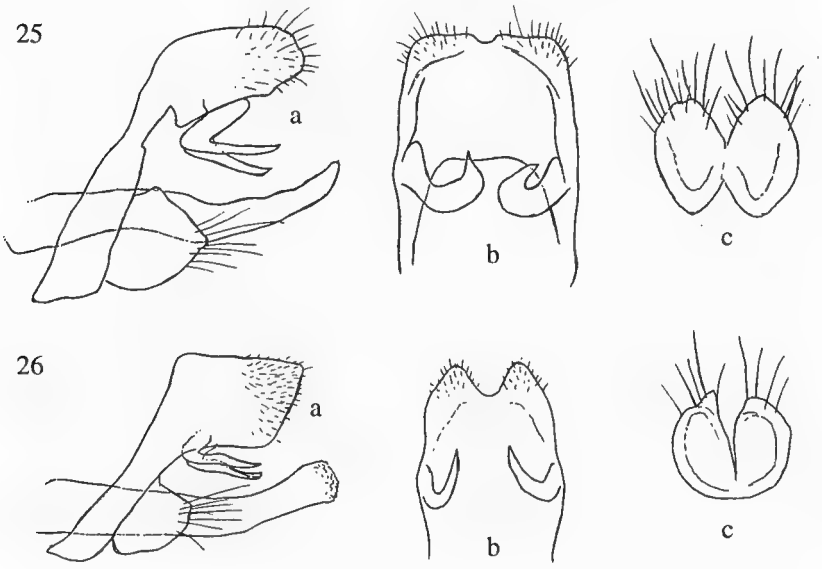
Description. Male (Figs 5-6). Forewing length 13 mm, antenna 8 mm. Head grey-black with eye ringed white, antenna black ringed white. Thorax and abdomen grey-brown, white beneath. Forewing with termen straight; upperside lavender blue with costa, apex and termen broadly dark brown;

underside creamy white. Hindwing upperside lavender blue with termen, costa and inner margin dark brown; underside creamy white with small black submedian spot between vein 1A+2A and anal vein, termen narrowly black.

Female (Figs 7-8). Forewing length 16 mm, antenna 9 mm. Head, antenna, thorax and abdomen as for male. Forewing upperside dark brown with pale bluish white basal area below cell, becoming darker blue near base and costa; underside as for male. Hindwing upperside dark brown with scattered blue scales in cell; underside as for male.

Male genitalia (Fig. 26). Sociuncus squared laterally, dorsally U-shaped anteriorly; brachium long, apically slender; valva squat, asymmetrical, roughly hemispherical, aedeagus elongate, rounded apically.

Etymology. Named after the Lak district, a local name referring to the bulge in southern New Ireland where the type series was collected.



Figs 25-26. Male genitalia of *Philiris* spp. from New Ireland. (25) *P. apicalis ginni*, (a) lateral view; (b) sociuncus, dorsal view; (c) valvae, ventral view. (26) *P. luscescens lak*, (a) lateral view; (b) sociuncus, dorsal view; (c) valvae, ventral view. Scale bar = 0.5 mm.

Comments. Parsons (1998) correctly assumed that specimens of *P. luscescens* Tite from New Ireland represent 'a distinct unnamed race'. Males of *P. l. lak* have much broader forewing apical margins and a lavender hue to the blue,

not developed in *P. l. luscescens*. Additionally, males of *P. l. lak* also have a very straight forewing termen. Parsons (1998) also commented on the distinctive genitalia of New Ireland specimens. Females of the two subspecies are very similar but those of *P. l. lak* may have more blue scales on the hindwing than the nominate subspecies.

P. l. lak was found to be extremely local in New Ireland, being recorded at only a single small locality. However, a female taken in the Schleinitz Mountains at 800 m, likely belongs to *P. l. lak*.

Philiris apicalis ginni subsp. nov.

(Figs 11-12, 25)

Types. Holotype ♂, PAPUA NEW GUINEA: ~12 km W of Taron Village, 550 m, southern New Ireland, 13.viii.1998, C.J. Müller (in ANIC). *Paratypes*: 2 ♂♂, same data as holotype, both with genitalia dissected and attached to specimen (1 in CJMC, 1 in SGC), 2 ♂♂, Weiten Valley, 250 m, southern New Ireland, 24.viii.1998, C.J. Müller (CJMC).

Description. Male (Figs 11-12). Forewing length 16 mm, antenna 9 mm. Head black with eye ringed white; antenna black ringed white. Thorax and abdomen black, grey beneath. Forewing upperside purple with black apical area tapering towards inner margin; underside grey. Hindwing upperside purplish-blue with termen narrowly black, costa and inner margin broadly grey-brown; underside grey, black along tornal veins at termen.

Male genitalia. (Fig. 25). Sociuncus pointed laterally, dorsally squared with tiny saddle anteriorly; brachium long and thick; valva squat and rounded, aedeagus elongate, irregular apically.

Etymology. Named after Mr Scott Ginn of Cherrybrook, New South Wales.

Comments. Males of *P. a. ginni* have much more extensive purple on the forewing upperside and the colour above of the fore and hindwings are more contrasting than those of *P. a. apicalis* Tite. The grey underside is distinctive amongst species of *Philiris* Röber from New Ireland.

P. a. ginni was found to be extremely local in New Ireland, being recorded at only two small localities. Males were collected at flowers together with *Hypochrysops arronica honora* Grose-Smith.

Udara drucei tennenti subsp. nov.

(Figs 9-10)

Types. Holotype ♀, PAPUA NEW GUINEA: Hans Meyer Range, 1700 m, southern New Ireland, 19.viii.1998, C.J. Müller (ANIC). *Paratypes*: 2 ♀♀, Hans Meyer Range, 2400 m, southern New Ireland, 22.viii.1998, C.J. Müller (1 in CJMC, 1 in BMNH).

Description. Female (Figs 9-10). Forewing length 20 mm, antenna 9 mm. Head grey, eye ringed white, antenna black, ringed white. Thorax and abdomen dark grey, grey-white beneath. Forewing termen fairly convex;

upperside dark brown with lustrous sky blue area extending from base through cell below radius to postmedian area and to inner margin, dark brown along discocellulars; underside grey-white, a submarginal and a postmedian band of brown spots, latter broken at vein M_1, also brown cell stripe parallel to discocellulars. Hindwing upperside dark brown with central lustrous sky blue area between vein M_2, inner margin and subterminal area; underside grey-white with a row of brown subterminal spots, also an irregular, broken median and basal band of brown spots, brown along discocellulars.

Male unknown.

Etymology. Named after Mr John Tennent, The Natural History Museum, London.

Comments. Females of *U. d. tennenti* are much larger than those of *U. d. drucei* (Bethune-Baker). The blue area on the upperside of the forewing is more extensive and more iridescent than in *U. d. drucei* but more reduced on the hindwing, while the markings on the underside of *U. d. tennenti* are much less distinct and brown rather than black.

U. d. tennenti was taken at high altitude in New Ireland, where females flew over the canopy on mountain tops, rarely settling for brief periods on both the branches and foliage of lauraceous trees. When males become available, it is possible that this subspecies will be found to be specifically distinct from *U. d. drucei* from mainland New Guinea.

Nacaduba zaron sp. nov.

(Figs 15-16)

Type. Holotype ♂, PAPUA NEW GUINEA: Schleinitz Mts, 1000 m, central New Ireland, 1.x.2000, C.J. Müller (ANIC).

Description. Male (Figs 15-16). Forewing length 16 mm, antenna 9 mm. Head black, eye ringed white; antenna black, ringed white. Thorax and abdomen black with fine hairs bluish-grey dorsally and brown beneath. Forewing with costa much longer than inner margin, termen straight; upperside iridescent purplish-blue, termen and cilia narrowly black; underside dark brown, a row of broad submarginal spots forming arrow shapes towards base, each outlined in white, a postmedian band of spots, displaced basally at vein CuA_1, a median and basal band in cell, both outlined in white, basal band continuing indistinctly to near inner margin. Hindwing with short black, white-tipped tail at vein CuA_2; upperside iridescent purplish-blue, costa, termen and cilia narrowly black; underside dark brown with large black subtornal spot between veins CuA_2 and CuA_1, finely outlined in metallic light blue, but replaced by orange near termen, a row of broad submarginal spots forming arrow shapes towards base, outlined in white, a postmedian, median and basal band all outlined in white and displaced at veins.

Comments. N. zaron is unlike any other known species of *Nacaduba* Moore and is characterised by its short hindwing tails, straight and rather short forewing termen, iridescent purplish-blue upperside and dark brown underside ground colour.

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LYCAENID BUTTERFLIES (LEPIDOPTERA: LYCAENIDAE) OF BRISBANE: NEW FOOD PLANT RECORDS AND LIFE HISTORY NOTES

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Abstract

Information is provided on 19 lycaenid species found in metropolitan Brisbane, southeast Queensland. Thirty-one new larval food plants are recorded for 9 species. Also included are life-history notes and/or records of lycaenids breeding within the inner city and suburban areas of Brisbane.

Introduction

Sixty-three butterfly species in the family Lycaenidae occur in the Greater Brisbane Region (defined by Poole 1995) of southeast Queensland, according to distribution data in Braby (2000). The rich diversity of butterflies occurring in the region has been attributed to its varied forest types and has been recognised due to a relatively high collecting effort (Kitching and Dunn 1999). Suburban areas support a large proportion of this diversity. Twenty-nine lycaenid species were recorded from a Mt Coot-tha garden (Hill and Kitching 1983), whilst breeding records of De Baar (1994) and Hill (1987) suggest suburban gardens and bushlands support a diverse and interesting lycaenid fauna. However, some suburban areas, particularly new developments isolated from natural habitat, support only a few common lycaenid species (Hill and Kitching 1983).

The following food plant list provides new records and/or life history notes for several lycaenids of metropolitan Brisbane. These records are additional to those of Braby (2000), who provided an extensive list of food plants and life-history details for the Australian lycaenid fauna. Species that breed in highly modified environments such as the City centre are identified.

Collecting focused on the southern and western suburbs and in the Brisbane City centre (George St, Ann St, North Quay and South Brisbane). New food plants are annotated under each species heading and known food plants are also listed where life-history information is given. Months indicate collection times of larvae and/or pupae. Nomenclature for butterflies follows Braby (2000). Attending ants collected during this study will be reported elsewhere.

Results

Hypochrysops cyane (Waterhouse & Lyell)

Amyema miquelii (Loranthaceae). Inala, Indooroopilly. Jan., Aug. 1999-2000. Larvae and pupae collected from beneath cardboard bands attached 3-4 m from the ground on the trunk and branches of *Eucalyptus seeana* and *E. tereticornis* (Myrtaceae). Larvae failed to develop on the eucalypt foliage, but did accept and develop normally on foliage of *A. miquelii*, which heavily

parasitised both trees. *Amyema miquelii* is a known food plant of *H. cyane* at Warwick, Qld (Braby 2000). A single tree at each site was utilised by *H. cyane* over successive generations, while other trees nearby with similar infestations of *A. miquelii* were not used. Pupae of *Ogyris oroetes* (Hewitson) and *O. olane* Hewitson were found together with *H. cyane* at both sites. Larvae collected in August produced adults in October, while larvae and pupae collected in January produced adults in February.

Ogyris oroetes oroetes (Hewitson)

Amyema miquelii (Loranthaceae). Indooroopilly, St Lucia, Corinda, Rocklea, Inala, Gailes, Acacia Ridge, Browns Plains and Eight Mile Plains. Jan.-May, Aug. 1999-2000. At least three generations were detected including late-summer (adults emerging from February to early March), autumn (adults emerging throughout May) and spring (adults emerging from August to September). Additional generations are likely to occur as adults have been collected or reared in all months (Braby 2000). Larvae feed on fresh young growth which is produced throughout the year. Pupal duration was 12 days in March-April, 23 days in August-September and 43 days in July-August. During winter the larval duration of the spring generation was 60-70 days. *Amyema miquelii* is a known food plant of this species (Braby 2000) and is a common parasite of *Eucalyptus tereticornis* and other *Eucalyptus* spp. in the above suburbs.

In Brisbane and elsewhere in southern Queensland, larvae are green and closely match the food plant foliage in colour. On two occasions (at Warwick and Leyburn) immature 4th and 5th (final) instar larvae were collected on *A. miquelii* foliage during the day. Common and Waterhouse (1981) reported green larvae feeding during the day at Mitchell. This behaviour may be more prevalent (at least in southern Queensland) than has previously been recognised. Immature larvae were never found sheltering during the day under bark near the mistletoe or near the base of the host tree as reported by Braby (2000), although mature (post-feeding) larvae and pupae were regularly found in these situations.

Ogyris olane Hewitson

Amyema miquelii (Loranthaceae). Indooroopilly, Rocklea, Inala, Gailes, Acacia Ridge, Browns Plains and Eight Mile Plains. Feb.-Mar., May, Aug.-Sep. 1999-2000. Three generations were collected. Pupal duration of the late summer generation was 10 days (February), spring generation 22 days (September), winter generation 38 days (June-July). An additional early summer generation may occur, but further collecting in November and December is required to confirm this. *Amyema miquelii* is a known food plant of *O. olane* (Braby 2000). Immature larvae sheltered under bark close to the mistletoe haustorium, while mature larvae and pupae were often found with those of *O. oroetes* under bark near the base of the host tree.

Ogyris amaryllis amaryllis (Hewitson)

Amyema cambagei (Loranthaceae). Wolston Ck (Wacol), Oxley Ck (Corinda), Moggill Ck (Brookfield), Pullen Pullen Ck (Pinjarra Hills), Aug.-Jan. 1999-2000. Common along watercourses wherever the food plant is locally common. Captive larvae accepted and developed normally on another common mistletoe, *A. miquelii,* but despite a considerable search effort no early stages were found on this plant in the field. This subspecies is known to feed only on *A. cambagei* throughout its range (Braby 2000) and our results support its monophagous status.

Rapala varuna (Horsfield)

Jagera pseudorhus (Sapindaceae). Sherwood Arboretum, Apr. 2000. Single mature larva feeding on flowers. Larva was pale yellow with pink markings.

Eriobotrya japonica (Rosaceae). Sherwood, Apr. 2001. Two mature larvae and several immature larvae and eggs found on flower buds and flowers.

Alphitonia excelsa (Rhamnaceae). Oxley Ck (Corinda), Toohey Forest, Dec. 1999 to Jun. 2000. Numerous larvae were found on flowers of this well-known food plant in all months from December to June, representing two or three generations. Pupal duration was 10 days in December-January, 16 days in March-April and 30 days in May-June.

Deudorix diovis Hewitson

Arytera foveolata (Sapindaceae). Oxley Ck (Corinda) and Moggill Ck (Kenmore), Nov. 1999 to Jan. 2000. Numerous larvae found in fruits. Mature larvae are partly exposed while feeding on seeds as the fruit lobes are smaller than the larva itself. Pupae were attached to leaf litter near the base of trees.

Cupaniopsis parvifolia (Sapindaceae). Oxley Ck (Corinda) and Sherwood, Nov., Dec. 1999. Numerous larvae found feeding on seeds and inner fruit wall.

Harpullia hillii (Sapindaceae). South Brisbane, Oct. 1999, 2000. Several mature larvae found feeding on fleshy inner wall of fruit capsules; seeds not present. Development was completed normally on fruit capsules.

Macadamia integrifolia (Proteaceae). Sherwood, Corinda, Mt Gravatt, South Brisbane, Oct. to Jan. Numerous larvae in 1999-2000, few in 2000-01. Larvae feed and complete development on the outer rind of fruit when the inner seed hardens. Pupae were found in hollowed branches and in cracks on the trunk. *Macadamia* is known as a food plant of *D. diovis* in Queensland (Braby 2000), although the species involved have not formerly been identified.

Macadamia tetraphyla (Proteaceae). St Lucia, Jan. 2000 & 2001. Evidence of larval feeding on fruits and several pupae found in crevices on lower trunk.

Larvae were also recorded on the known food plants *Harpullia pendula, Cupaniopsis anacardioides* (Sapindaceae), *Buckinghamia celsissima* (Proteaceae) and *Elaeocarpus angustifolius* (Elaeocarpaceae) in suburban Brisbane. *D. diovis* is common throughout Brisbane as a result of the use of these plants as street trees. *Harpullia pendula* trees were heavily colonised even in the City centre (George St and South Brisbane).

A second instar larva was discovered in the fruit of *Diploglottis campbelli* (Sapindaceae) collected in February 2000, from the Tallebudgera district. This larva was reared to the final instar but failed to pupate. Four hatched *D. diovis* eggs were found on fallen fruits of *Diploglottis australis* at the Sherwood Arboretum in October but no larvae were found and there was little indication of larval feeding on these fruits. Four larvae (instars I, II and III) were experimentally reared on *D. australis* fruit and, although all developed to the final instar (and two pupated), none survived to produce adults.

Larvae were successfully reared from second instar to adult on *Syzygium australae* (Myrtaceae) and *Jagera pseudorhus* (Sapindaceae) fruits, but early stages were not found on either in the field. Likewise, *Eriobotrya japonica* (Rosaceae) seeds are accepted by captive larvae (Waterhouse 1932) but we found no evidence that *D. diovis* will oviposit on these fruits in the field.

Candalides margarita (Semper)

Amyema miquelii (Loranthaceae). Rocklea, Apr., May 1999. Eggs, discovered singly on young shoots in late April, produced adults in July. Larval duration was 38-39 days in May-June. Pupal duration was 41-42 days in June-July. A single mature larva was found feeding on foliage at mid-day during April. Larvae fed along leaf edge leaving no distinctive feeding trail and were well camouflaged on the foliage.

Candalides absimilis (C. Felder)

Harpullia pendula (Sapindaceae). Herston, Feb. 2000. Two larvae were found feeding on flowers in the company of numerous *Catopyrops florinda* (Butler) larvae. *Candalides absimilis* was reported ovipositing on *H. pendula* shoots in Brisbane (Braby 2000) and the present record confirms *H. pendula* as a food plant.

Cupaniopsis anacardioides (Sapindaceae). South Brisbane, Feb. 2001; Springwood, Jan., Oct., Dec. 2000. This is a well-known food plant of *C. absimilis* and several larvae were found feeding on tender foliage close to the City centre in February. The larvae were in the company of larvae of *Nacaduba berenice* (Herrich-Schäffer) which are more common on this plant in inner City locations.

Stenocarpus sinuatus (Proteaceae). Sherwood Arboretum Apr. 2000. Eggs and two pink larvae found on flowers.

Nacaduba berenice (Herrich-Schäffer)

Cupaniopsis anacardioides (Sapindaceae). Coopers Plains, Aug. 2000. Several mature larvae feeding on immature fruits. *Nacaduba berenice* normally feeds on fresh foliage or flowers of this plant (Braby 2000).

Cupaniopsis parvifolia (Sapindaceae). Oxley Ck (Corinda) and Sherwood, Apr. 2000. Eggs and numerous larvae found feeding on tender, young foliage.

Elatostachys nervosa (Sapindaceae). Mt Coot-tha Botanical Gardens, Apr. 2000. Eggs and numerous larvae found feeding on soft, pink foliage.

Elatostachys microcarpa (Sapindaceae). Mt Coot-tha Botanical Gardens, early Nov. 2000. Tree native to northern Queensland. Numerous larvae were found on flowers and immature fruits. Most larvae were seen feeding on immature fruits as few flowers remained.

Arytera foveolata (Sapindaceae). Oxley Ck (Corinda), Dec. 1999. Eggs and numerous larvae of all stages feeding on tender, young foliage. All new growth was stripped from some heavily colonised, small trees.

Jagera pseudorhus (Sapindaceae). Sherwood Arboretum, Apr. 2000. Three mature larvae found feeding on flowers in the company of *Erysichton lineata* (Murray) larvae.

Nacaduba berenice is common throughout suburban Brisbane (Braby 2000, this study). In the City centre, larvae were regularly found feeding on tender, young foliage of *C. anacardioides*. Larvae were recorded on this plant in January, February, March, April, July, August, September and October. Pupal duration on this plant was six days in January, 13 days in April-May, and 9 days in September. Larvae were also found on other known food plants: *Macadamia integrifolia* (flowers, Sherwood, Aug. 2000), *Arytera divaricata* (tender foliage, Sherwood, Apr. 2000) and *Guioa ?acutifolia* [unconfirmed: Qld Herbarium] (tender foliage, Oxley Ck, Dec. 2000).

Early stages were not found on *Harpullia pendula* despite searching many trees. Rearing experiments with six larvae showed that they refused to feed on tender young shoots of this plant, but would develop normally on the flowers. A search of *Toechima tenax* (Sapindaceae) at Brisbane Botanical Gardens and at Moggill Ck revealed no immature stages, even when soft, fresh growth was abundant and larvae were found nearby on other food plants. The reason for avoidance of this plant in the field is unknown as larvae fed and developed normally on it in captivity.

Nacaduba biocellata (C. Felder & R. Felder)

Acacia disparrima subsp. *disparrima* (Mimosaceae). Rocklea, May 2000. Two larvae feeding on flowers in the company of more numerous *Prosotas felderi* (Murray) and *Sahulana scintillata* (T.P. Lucas) larvae.

Erysichton lineata (Murray)

Brachychiton acerifolium (Sterculiaceae). Sherwood Arboretum, late Oct. 2000. A single mature larva was found feeding on flower buds. The larva was bright green and conspicuous against the red buds.

Jagera pseudorhus (Sapindaceae). Sherwood Arboretum, Apr. 2000. Two larvae found on flowers in the company of larvae of *Nacaduba berenice*. Larvae were cream with pink dorsal and dorso-lateral stripes.

Miscarytera lauteriana (Sapindaceae). Mt Coot-tha Botanical Gardens, Jul. 2000. Three mature larvae found feeding on flowers.

Elatostachys microcarpa (Sapindaceae). Mt Coot-tha Botanical Gardens, early Nov. 2000. Tree native to northern Queensland. Numerous mature larvae were found feeding on flowers in the company of *Nacaduba berenice* larvae.

Alectryon subcinerius (Sapindaceae). Mt Glorious, Nov. 2000. Numerous larvae found feeding on flowers. Not a suburban record, but this tree does occur along creeks in Brisbane.

Harpullia pendula (Sapindaceae). Sherwood Arboretum, Dec. 2000, Feb. 2001. A single mature larva was found feeding on flower buds in December, while two first instar larvae were found on flower buds in February. A pre-pupal larva was found attached to a dead leaf caught in a trunk fork in February. *Erysichton lineata* has previously been reported ovipositing on flowers of *H. pendula* (Braby 2000) and the present records confirm it as a food plant.

Syzigium francisii (Myrtaceae). Oxley Ck (Corinda), late Oct. 2000. Several eggs, three first instar and one second instar larvae found and reared on flower buds.

Pupal duration was 6 days in February, 8-9 days in April and May and 7 days in November and December.

Psychonotis caelius (C. Felder)

Alphitonia excelsa (Rhamnaceae). Oxley Ck (Corinda), Toohey Forest, early Nov. to early July. A well-known food plant throughout the range of this species. In addition to feeding on the underside of leaves, larvae were found and reared on the flowers. Outside of the period recorded above, the foliage was old and dry and no larvae were found.

Alphitonia petriei (Rhamnaceae). Mt Coot-tha Botanical Gardens, Apr. 2000. Several larvae found feeding on the underside of foliage. Recently recorded as a food plant in northern Queensland (Braby 2000).

Prosotas felderi (Murray)

Acacia disparrima subsp. *disparrima* (Mimosaceae). Rocklea, May 2000. Numerous larvae found feeding on flowers.

Acacia falcata (Mimosaceae). Toohey forest, Jun. 2000. Three larvae found feeding on flower heads.

Acacia concurrens (Mimosaceae). Toohey Forest, Jun. 2000. Numerous larvae found feeding on flowers.

Harpullia pendula (Sapindaceae). Sherwood Arboretum, Dec. 2000. A single larva was found feeding on flower buds.

Prosotas dubiosa (Semper)

Acacia maidenii (Mimosaceae). Sherwood Arboretum, Apr. 2000. A single larva was found feeding on flowers.

Alectryon tomentosus (Sapindaceae). Sherwood Arboretum, Dec. 2000. An adult male was reared from a pupa attached to leaf litter accumulated in the fork of a large flowering tree.

Harpullia pendula (Sapindaceae). Sherwood Arboretum, Feb. 2001. A single larva was found feeding on flower buds in the company of *Erysichton lineata* and *Catopyrops florinda* larvae.

Catopyrops florinda (Butler)

Harpullia pendula (Sapindaceae). Herston and City centre, Apr. 2000; Benwarra Park (Corinda), Feb. 2000; Rocklea, Mar. 1999. Numerous larvae found feeding on flowers at Herston and several found in the City centre. Two mature larvae were feeding on terminal shoots at Benwarra Park. A pupa was found inside a hollow *H. pendula* fruit capsule previously eaten out by *Deudorix diovis* at Rocklea. Braby (2000) recorded *H. pendula* as a food plant near Brisbane. This is the only lycaenid currently known to feed on *Harpullia* foliage in Brisbane, although flowers are preferred when both are available.

Sahulana scintillata (T.P. Lucas)

Acacia disparrima subsp. *disparrima* (Mimosaceae). Rocklea, May 2000. Numerous larvae found feeding on flowers.

Acacia maidenii (Mimosaceae). Oxley Ck (Sherwood), Jun. 2000. Three mature larvae feeding on flowers.

The site of pupation for this species is unrecorded. A freshly emerged male was found expanding its wings on exposed tree roots several metres from the base of the food plant. It is likely (though unconfirmed) that this individual emerged from a pupa on the ground.

Lampides boeticus (Linnaeus)

Macroptilium atropurpureum (Fabaceae). South Brisbane, Corinda, Oct. to Nov. 2000. Females observed ovipositing on flowers. Eggs were found on most flowers examined. Several mature larvae were recovered from flower buds.

An adult female was observed ovipositing on flower buds of *Bauhinia galpinii* (Caesalpiniaceae) at South Brisbane in January, 2000. No larvae or evidence of feeding were seen on the plant. Approximately 10 eggs were collected on *B. galpinii* flower buds and brought into captivity but none of the resulting larvae survived beyond the first instar. Newly hatched larvae were observed to tunnel through the calyx but failed to feed on the inner flower. About 20 eggs were found on buds of the same plant in November 2000 and again larvae failed to develop. The known larval food plants of *L. boeticus* are restricted to the Fabaceae (Braby 2000) and it appears that oviposition on *B. galpinii* was a mistake.

Leptotes plinius (Fabricius)

Plumbago auriculata (Plumbaginaceae). Larvae are common on this known food plant throughout Brisbane, including the City centre (*e.g.* George St). At Sherwood larvae were found in all months of the year as the plant flowers continuously.

Zizina labradus (Godart)

Neonotonia wightii (Fabaceae). South Brisbane, Sep. to Oct. 2000. Numerous eggs and larvae were found on flowers. Braby (2000) listed this plant as *Glycine wightii*.

Discussion

Braby (2000) provided the most recent and comprehensive listing of larval food plants for the Australian Lycaenidae. The 31 additional food plant records presented here are mostly within plant genera or families which are known food plants of these butterflies. Exceptions include the records of *Erysichton lineata* feeding on *Brachychiton acerifolium* (Sterculiaceae) and *Rapala varuna* feeding on *Eriobotrium japonicum* (Rosaceae). The full host plant range of many lycaenid species remains to be documented. *Deudorix diovis*, *Candalides absimilis*, *Nacaduba berenice* and *Erysichton lineata*, for example, each use a wide range of food plants in the Sapindaceae and it is likely that additional food plants will be added as a greater range of plants in this family are investigated.

The diversity of rainforest plants in the Sapindaceae in southeast Queensland (48 species in the Moreton District: Henderson 1997) and the variation among species in flower and foliage production throughout the year, make this group an important resource for some continuously brooded lycaenids.

Erysichton lineata for example, although not restricted to the Sapindaceae, can be found utilising flowers of a variety of species in this family at different times of the year. The ability to feed on a wide range of plants in this family (and others) therefore enables certain species to remain in the area and complete multiple generations annually.

All lycaenid species included here tolerate human disturbance and breed on garden or street trees or on plants occurring in remnant patches of bushland. Seven species were found breeding on street trees, garden plants or weeds in or close to the central business district of Brisbane (*Deudorix diovis*, *Nacaduba berenice*, *Candalides absimilis*, *Catopyrops florinda*, *Leptotes plinius*, *Lampides boeticus*, *Zizina labradus*). These common species were also recorded in suburban Townsville (Valentine 1993, 1994) and elsewhere in suburban Brisbane (Hill and Kitching 1983). Urbanisation has possibly increased the availability of food plants for some or all of these butterflies. For example, several *D. diovis* food plants are now common street trees throughout Brisbane and the butterfly has consequently expanded into drier areas in which it could not have formerly bred.

Preservation of natural bushland remnants and remnant riparian habitats is clearly important for the maintenance of local populations of other lycaenid species whose food plants are not well represented in urban landscapes. Retention of large mistletoe-supporting trees is important for the continued presence of mistletoe-feeding species. Three mistletoe-feeding species, *Ogyris amaryllis*, *O. oroetes* and *O. olane*, not formerly thought of as suburban butterflies, are shown to be well distributed through Brisbane in areas where food plants remain. Each of these species is also known from suburban Townsville (Valentine 1993, 1994).

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